morrison

DINOSAURS!

•DISCOVER THE GIANTS OF THE PREHISTORIC WORLD•

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CHASMOSAURUS

Chasmosaurus was an impressive sight, lumbering along with its huge neck frill fanning out like a cloak.

Horned *Chasmosaurus* is the earliest known dinosaur with a long neck frill. This sturdy dinosaur was found in the valley of the Red Deer River in Alberta, Canada.

SPACED OUT

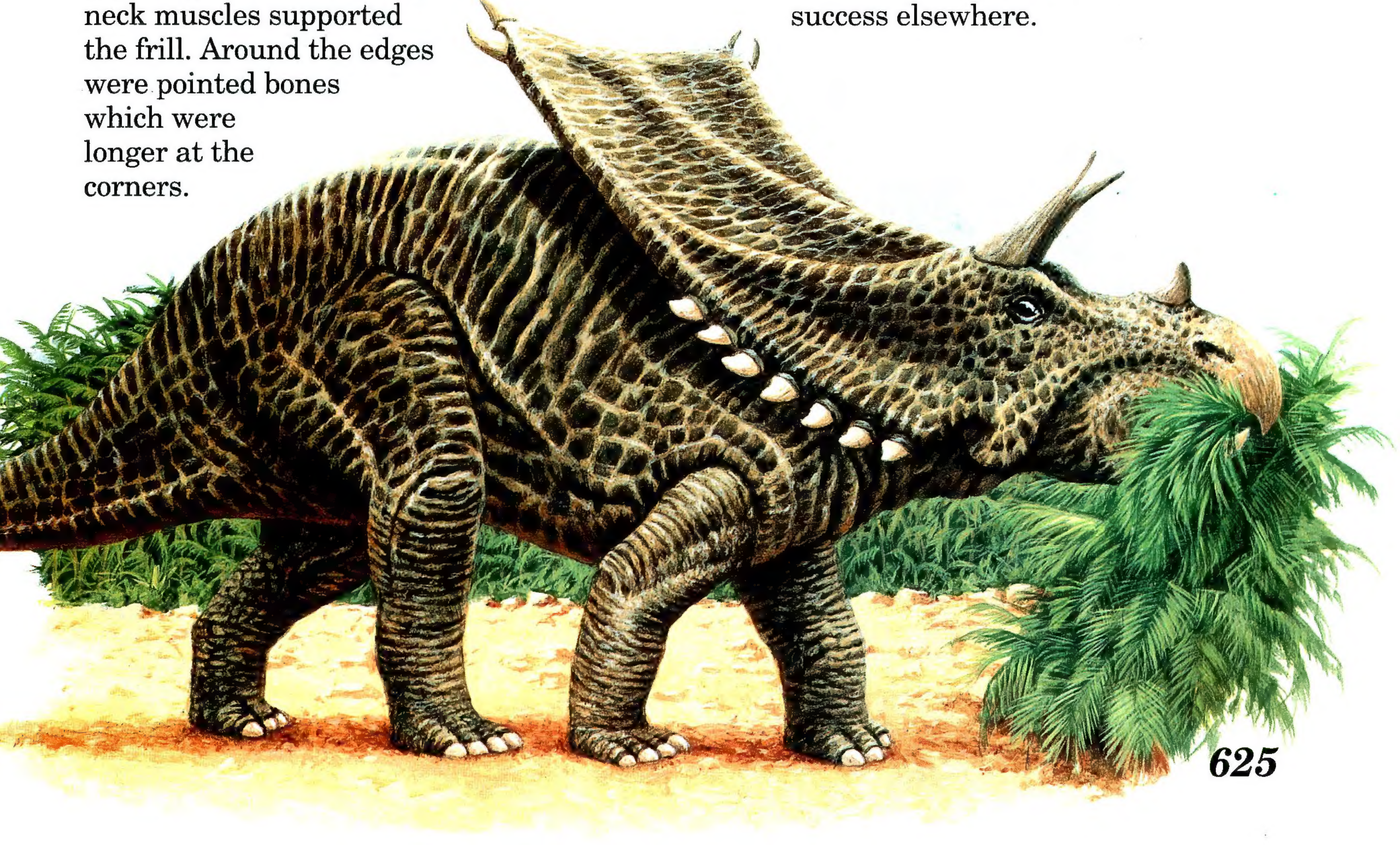
Although *Chasmosaurus'* enormous, rectangular frill was longer than its skull, it was not made from solid bone. Two big spaces or 'windows', filled with muscle and covered by skin, made the frill quite light. The holes were separated by a ridge of bone. Strong neck muscles supported the frill. Around the edges were pointed bones which were longer at the corners.

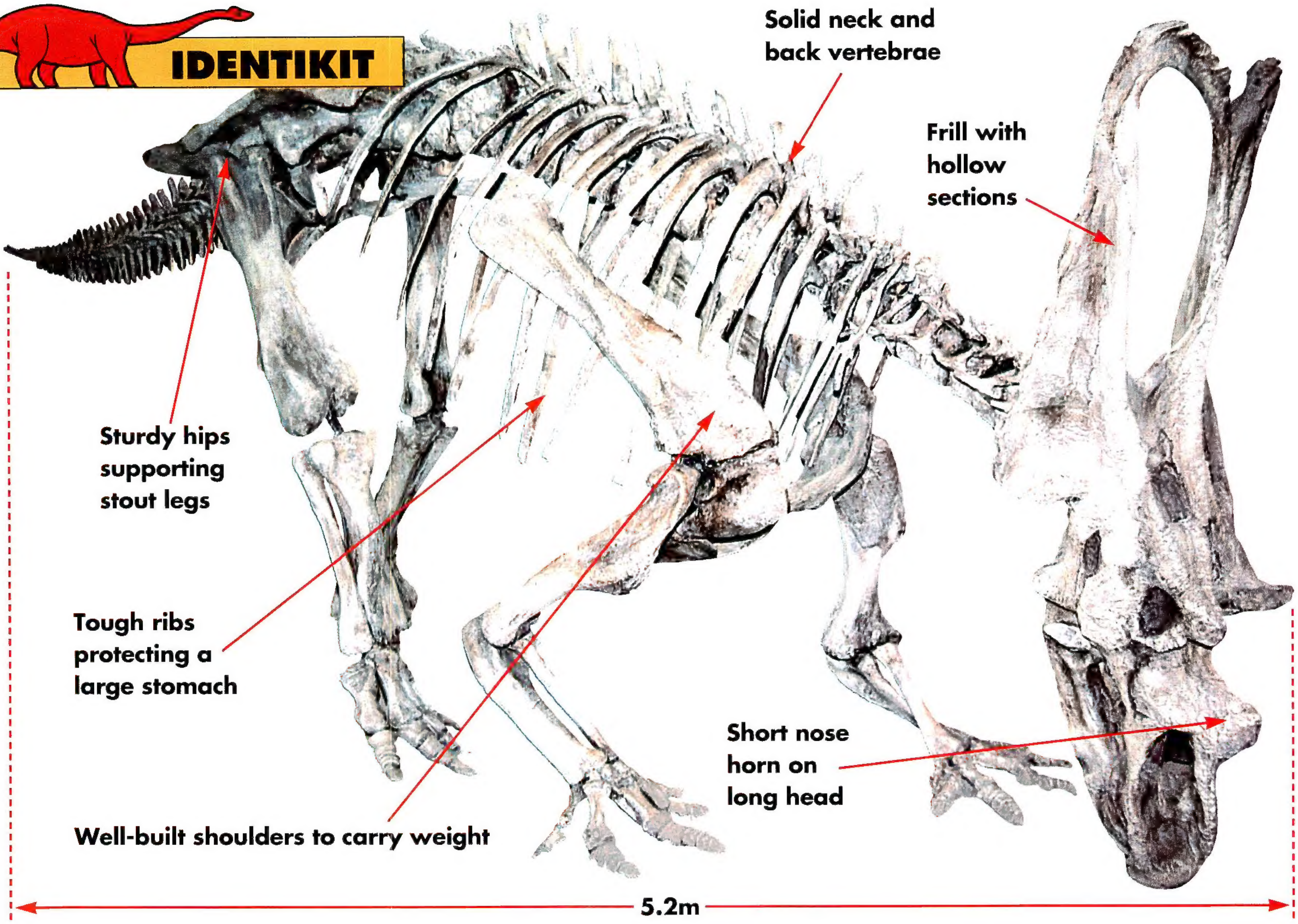
SHOW-OFF

Chasmosaurus was as long as a small car and as heavy as a rhinoceros. Its delicate frill was probably just for show. By nodding its head and waving the frill from side to side, *Chasmosaurus* was able to scare off many enemies. Its sharp horns were much more useful as weapons.

HORNED COMBAT

Above each eye and at the end of its snout *Chasmosaurus* had pointed horns. Some scientists think that the males had longer horns than the females. Rival males probably locked together their eyebrow horns like stags, and wrestled until one of them gave in. The victorious dinosaur won the right to mate with a female. The loser would have wandered off to look for success elsewhere.




Solid neck and back vertebrae
Frill with hollow sections
Sturdy hips supporting stout legs
Tough ribs protecting a large stomach
Short nose horn on long head
Well-built shoulders to carry weight
5.2m

SAFETY IN CIRCLES

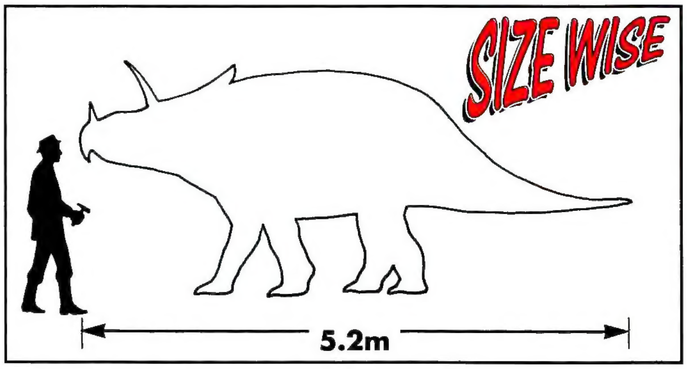
Plant-eating *Chasmosaurus* probably lived in herds. This safeguarded them when they moved through open spaces. If the herd was threatened by a meat-eater, the young were gathered together and the adults formed a defensive ring around them. With such an array of frills and horns pointing at them, predators were unlikely to try to invade the circle.

STRONG SKELETON

Chasmosaurus needed a strong framework of bones to support its bulky body. It walked on four stout legs which were attached to strong muscles in its hips and shoulders. Thick ribs strengthened its heavy body, like steel girders, and protected its large stomach. *Chasmosaurus* probably spent most of the day placidly browsing on its favourite plants.

MONSTER FACTS

- **NAME:** *Chasmosaurus* (kaz-mo-saw-rus) means 'ravine reptile'
- **SIZE:** 5.2m long
- **FOOD:** plants
- **LIVED:** about 80 million years ago in the Late Cretaceous Period in Alberta, Canada and New Mexico, USA



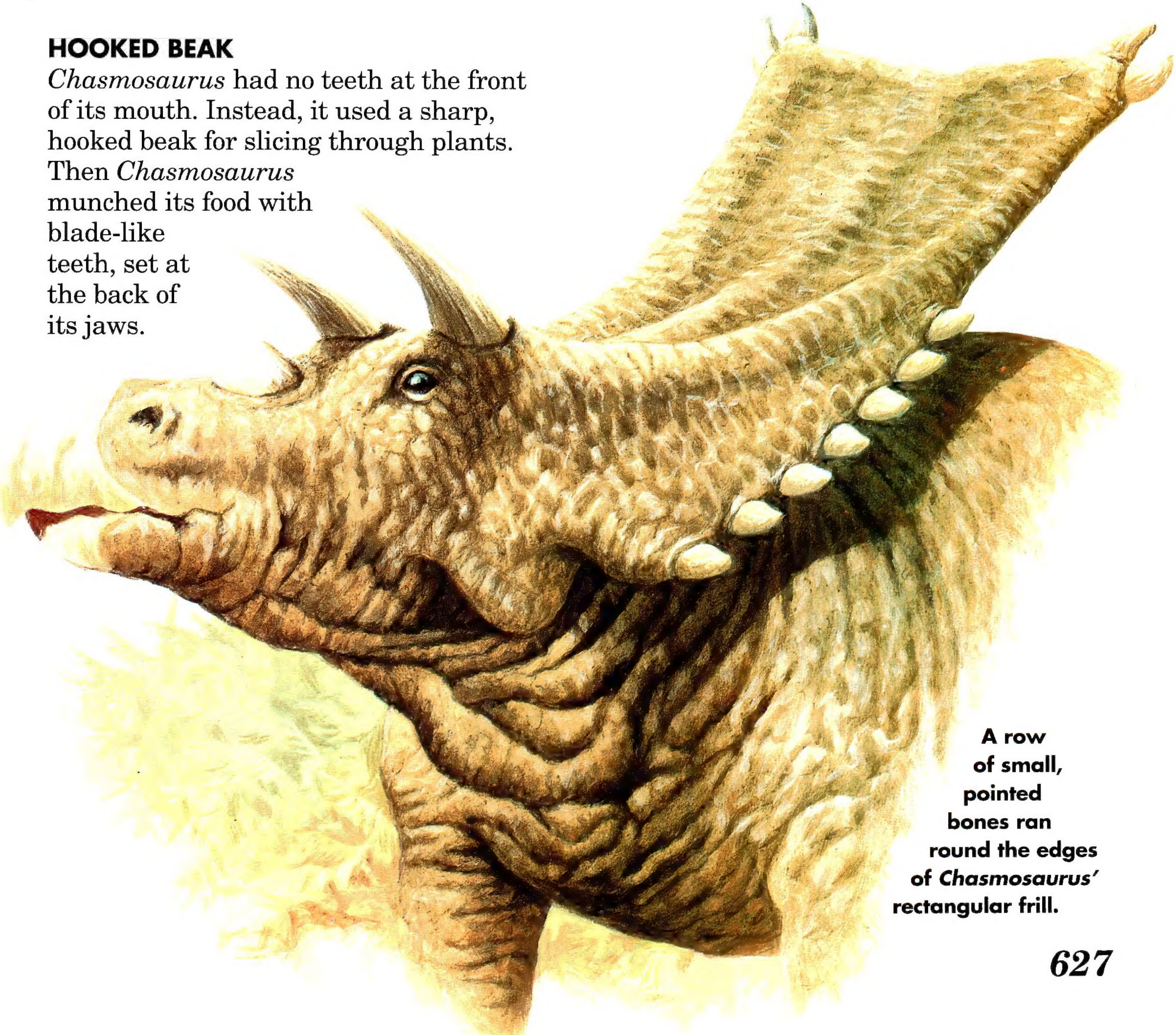
Like stags today, *Chasmosaurus* may have locked horns with a male rival to win the right to mate with a female.

Is it true that all the ceratopian dinosaurs had holes in their neck frills?

Most horned dinosaurs had 'windows' or openings in their neck frills which made them lighter. But *Triceratops* was the exception. It had a solid frill without any holes. This meant that it could use its frill as a shield to protect its neck and shoulders when it was attacked by predators, or when fighting rivals for leadership of the herd.

HOOKED BEAK

Chasmosaurus had no teeth at the front of its mouth. Instead, it used a sharp, hooked beak for slicing through plants. Then *Chasmosaurus* munched its food with blade-like teeth, set at the back of its jaws.

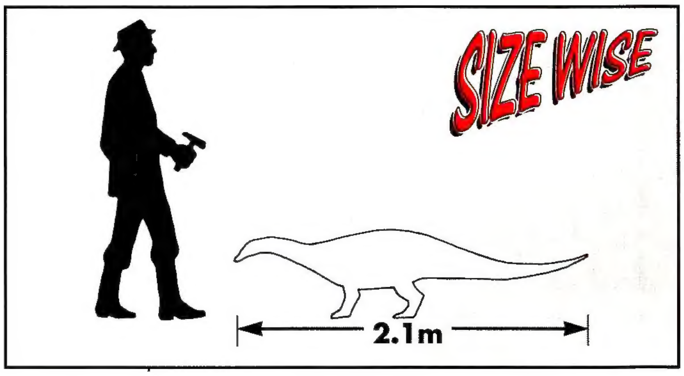


A row of small, pointed bones ran round the edges of *Chasmosaurus'* rectangular frill.

THECODONTOSAURUS

Little *Thecodontosaurus* was trapped by mud and sand after falling between cracks in limestone rock.

The first fragment of this early dinosaur, a piece of its jaw, was found in Bristol in south-west England, about 150 years ago. Other remains, including rib, arm and leg bones, were found later in ancient caves.



MONSTER FACTS

- **NAME:** *Thecodontosaurus* (theek-oh-dont-to-saw-rus) means 'socket-toothed reptile'
- **SIZE:** 2.1m long
- **FOOD:** plants
- **LIVED:** about 210 million years ago in the Late Triassic Period in south-west England, New Mexico, USA

KNEE HIGH

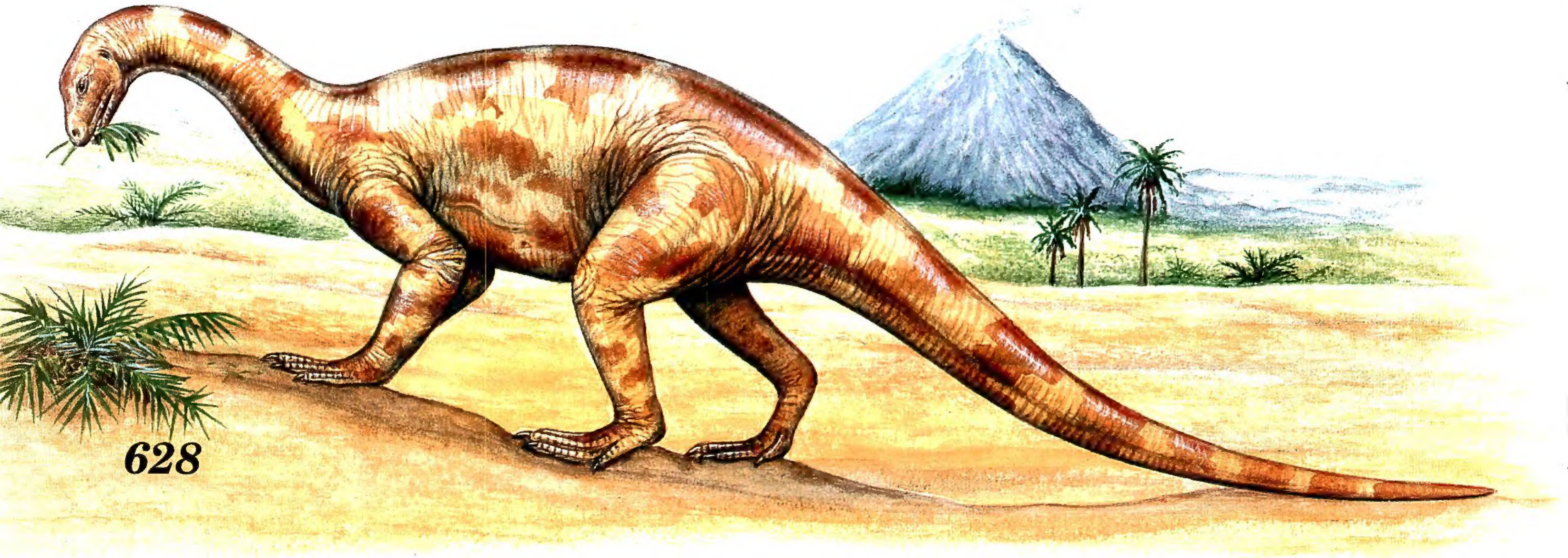
Thecodontosaurus was a plant-eating dinosaur, about as big as an average-sized dog. On four legs it was about as high as an adult human's knee. But it usually walked on two legs, craning its head up to reach tempting shoots. *Thecodontosaurus* may have steadied itself with its long tail when browsing.

HANDY HOOK

Thecodontosaurus had a large, curved thumb claw on each hand. It used the claw as a grappling hook to pull down high branches to feed from. If disturbed by a predator, the claw became a weapon as the dinosaur struck out to defend itself.

LEAF STRIPPER

Thecodontosaurus stripped branches with leaf-like teeth. Along the edges of these teeth were little ridges which pointed upwards. These worked like tiny rakes and cutters as the dinosaur pulled away and ripped off shoots and leaves.



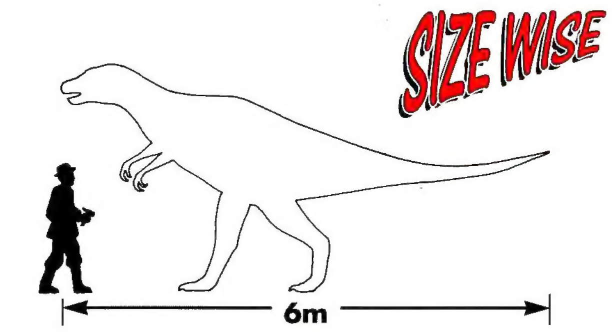
DRYPTOSAURUS

***Dryptosaurus* was as long as an elephant and very agile for its size.**

When *Dryptosaurus* was named in 1866, the scientist who discovered it, Edward Cope, thought it leapt at its enemies. So he gave it the name *Laelaps*, which was a mythological creature that turned into stone as it leapt in the air. But an insect had already been given that name, so it could not be used for a dinosaur. *Laelaps* was then renamed *Dryptosaurus*.

KANGAROO-SHAPED

Dryptosaurus was a fierce, meat-eating dinosaur. It walked upright on two strong-muscled legs like a kangaroo. Its toes had long, curved claws which could rip apart the flesh of its prey.

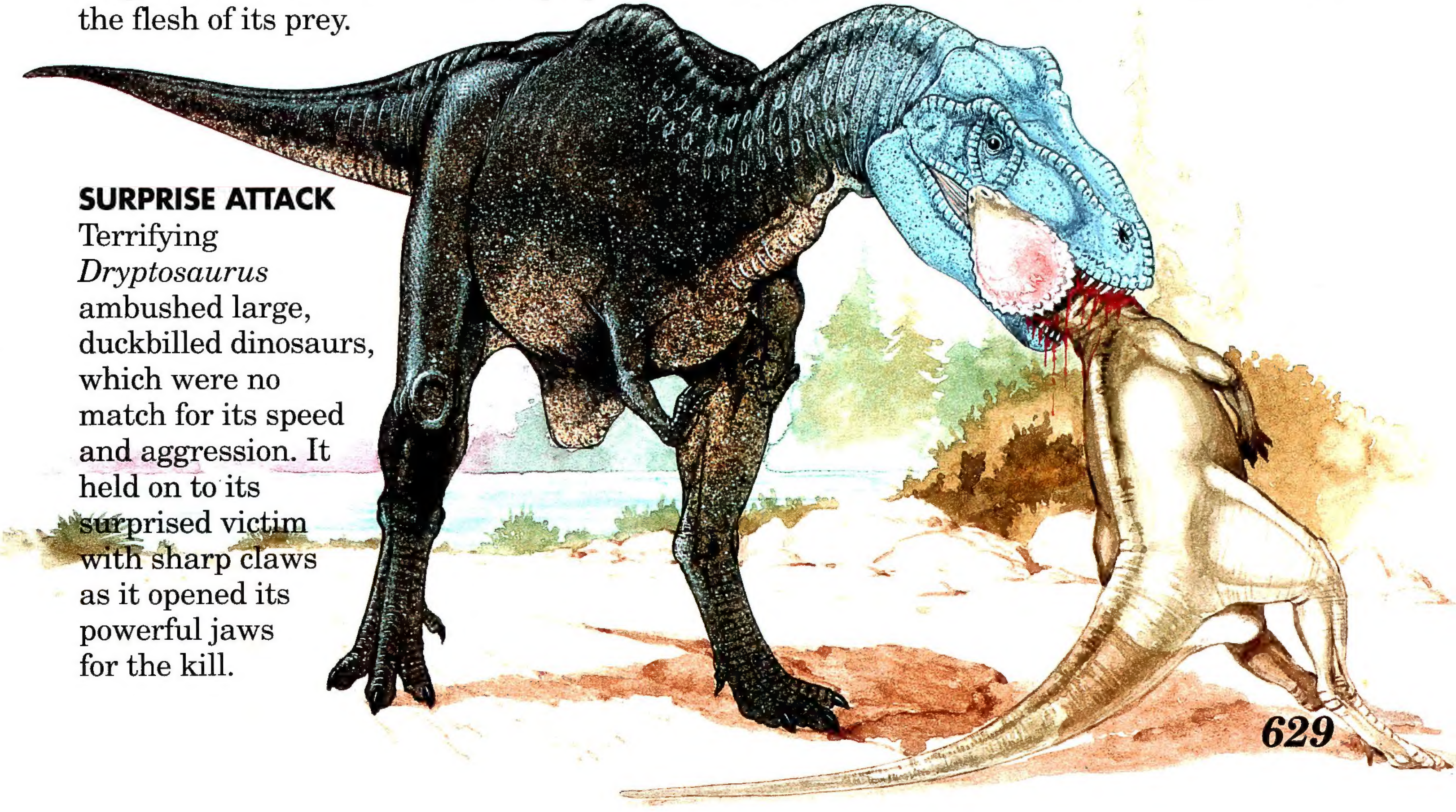


MONSTER FACTS

- **NAME:** *Dryptosaurus* (drip-toe-saw-rus) means 'wounding lizard'
- **SIZE:** about 6m long
- **FOOD:** meat
- **LIVED:** about 80 million years ago in the Late Cretaceous Period in North America

SURPRISE ATTACK

Terrifying *Dryptosaurus* ambushed large, duckbilled dinosaurs, which were no match for its speed and aggression. It held on to its surprised victim with sharp claws as it opened its powerful jaws for the kill.



Desert dinosaurs

Life in the desert is tough. How could dinosaurs survive an endless drought under the blistering heat of the sun?

In all but the driest deserts, some plants grow, such as cacti. Where there are plants, there are animals to eat them. Rocks and fossils show that there were deserts on Earth during the Age of the Dinosaurs. And some dinosaurs managed to live there.

EARLY DESERT DWELLERS

Layers of sandstone rocks formed during the Triassic, when the earliest dinosaurs appeared. The sandstone is made of sand grains that once blew about in dry scrub and deserts. The grains were buried, squeezed, and cemented together into rocks. Dinosaurs are preserved in these rocks.

Is it true that deserts can be freezing cold?

Yes. A desert is a very dry place, with 100mm rain or less each year. It can be hot, like Death Valley in California, where temperatures soar to over 50°C (halfway to boiling water). Or it may be cold, like parts of Antarctica, where the water falls mainly as snow.

Many deserts can be baking hot by day, but become bitterly cold at night.

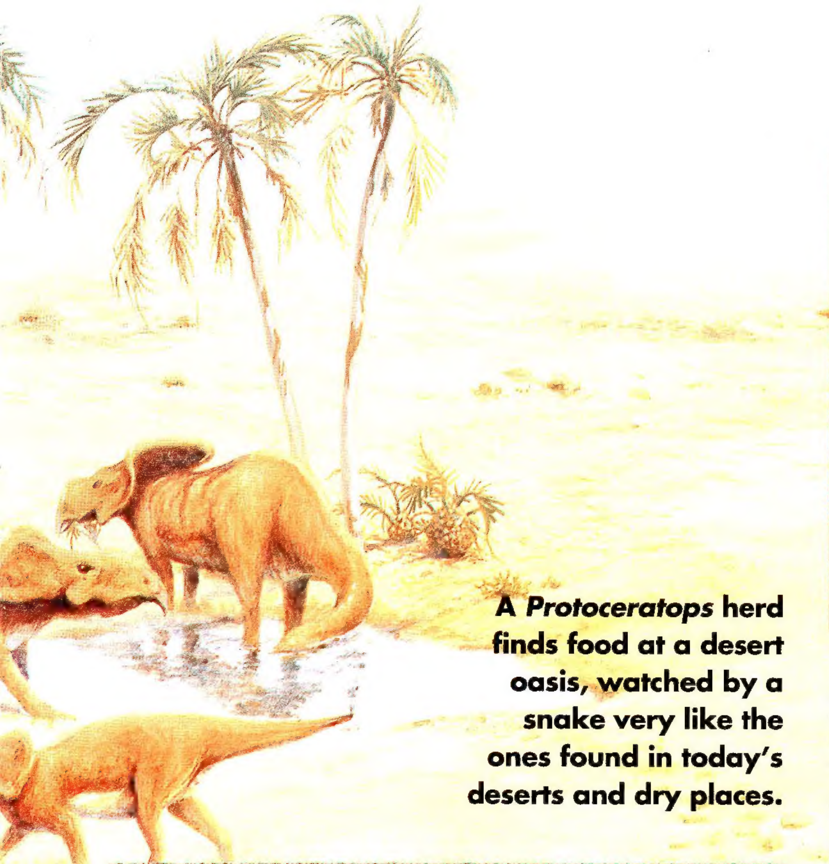
SAND INCUBATORS

In the 1920s, an American fossil-hunting expedition made amazing finds in the red desert sandstone rocks of the Gobi Desert in Mongolia. There were dozens of skeletons of *Protoceratops*, a small horned dinosaur from 80 million years ago. They were all sizes, from babies to adults. And there were fossilized nests containing dinosaur eggs. Hot desert sand makes an ideal incubator for eggs.

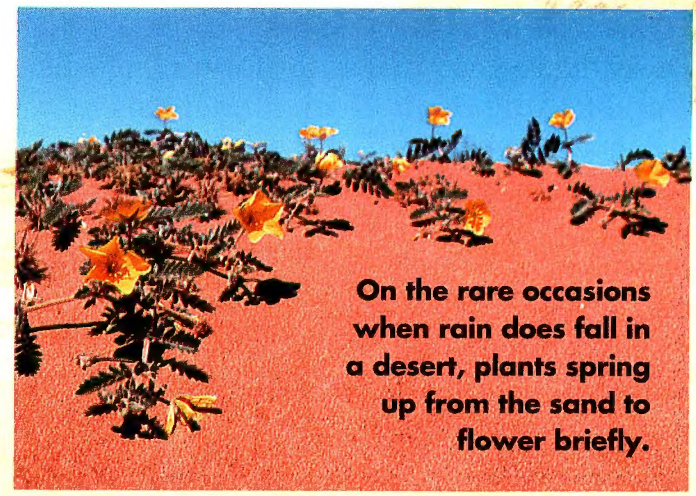
THE EGG-STEALERS

Protoceratops mothers probably dug shallow pits and laid their eggs in the sand. They may have guarded their nests until the babies hatched.

In today's deserts, there are plenty of egg-eaters ready to steal a meal.



A *Protoceratops* herd finds food at a desert oasis, watched by a snake very like the ones found in today's deserts and dry places.



On the rare occasions when rain does fall in a desert, plants spring up from the sand to flower briefly.

AT HOME IN THE SUN

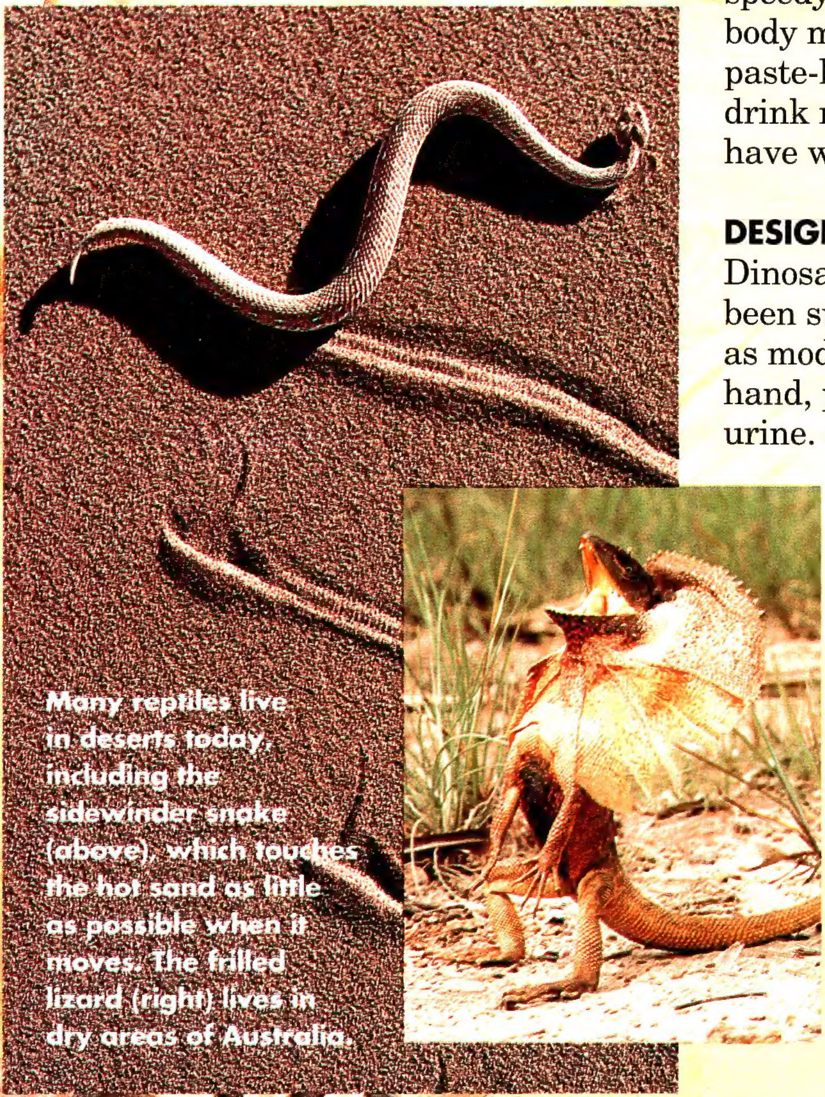
Reptiles are common desert animals today. Lizards and snakes bask in the sun to warm their bodies so they are ready for speedy action. Their scaly skin keeps in body moisture, and their urine is thick and paste-like. This means they do not need to drink much water to survive. Reptile eggs have waterproof shells that do not dry out.

DESIGNED FOR THE DESERT

Dinosaurs were reptiles, and would have been suited to desert life in the same way as modern reptiles. Mammals, on the other hand, pant and sweat and produce liquid urine. So their bodies need more water.

EARLY ADVANTAGE

During the Triassic Period, both dinosaurs and mammals were beginning to appear. But the huge supercontinent of Pangaea was hot and dry in the centre. The climate was damper around the edges of the continent near the sea, but much of the world's land was dry and desert-like. The fact that reptiles were well-suited to life in such places may have been one reason why dinosaurs took over, and mammals did not.



Many reptiles live in deserts today, including the sidewinder snake (above), which touches the hot sand as little as possible when it moves. The frilled lizard (right) lives in dry areas of Australia.

FORMING DESERT FOSSILS

Deserts are good places for forming fossils – and finding them. If an animal dies in a damp place, its body is soon eaten by scavengers, and rots in the dampness. In a desert, the body might be quickly covered by windblown sand, so it is more likely to be preserved. The heat and dryness can even turn the body into a dried-out 'mummy', so that some of the soft parts turn into fossils.

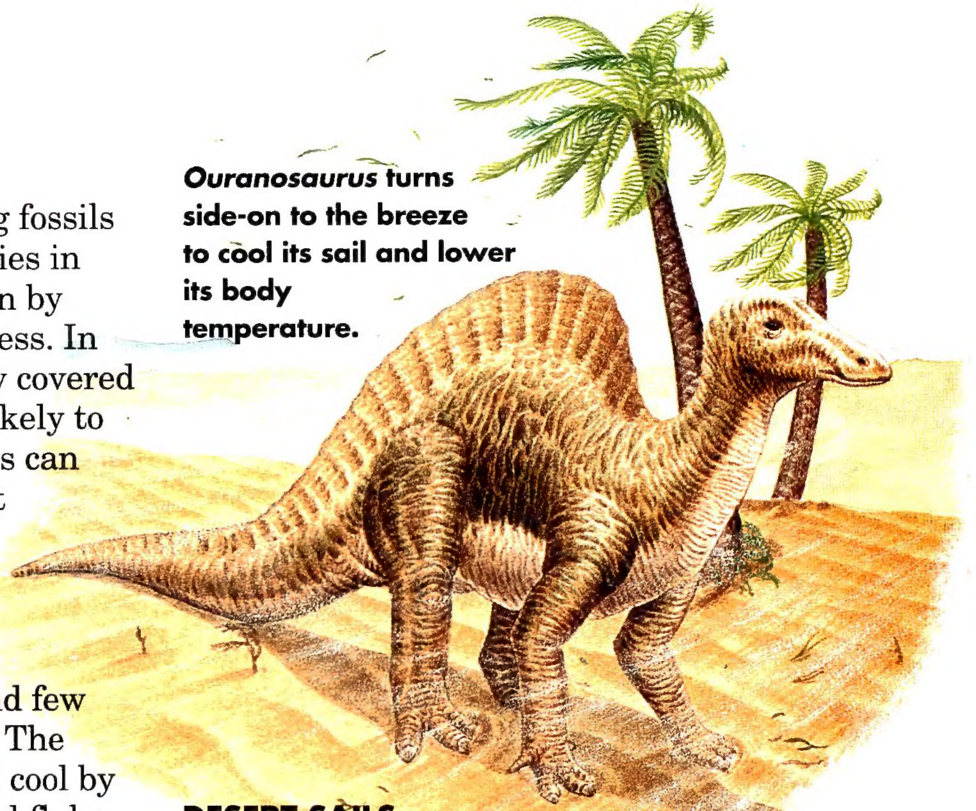
DESERT EROSION

In the desert, there is little soil, and few trees and plants cover the ground. The bare rocks are very hot by day and cool by night, which makes them crack and flake. Wind and sudden rainstorms move and wear the pieces of rock into small particles of sand. This means that new rocks are continually exposed – and so are fossils.

FINDING FOSSILS

Many dry areas, such as the Badlands of western North America, and the Gobi Desert of Mongolia, are superb places for fossil-hunters. But people face the same problems as animals, including extreme heat and cold, as well as sunburn and dryness.

***Spinosaurus* catches a lizard for breakfast after a chilly night in the desert.**



***Ouranosaurus* turns side-on to the breeze to cool its sail and lower its body temperature.**

DESERT SAILS

Some dinosaurs may have had ways of surviving the hot sun and desert conditions. *Ouranosaurus* was a 7m-long dinosaur whose fossils come from Cretaceous rocks in Africa. The area was probably desert at the time. This dinosaur had a tall sail of skin along its back.

WARMING AND COOLING

Ouranosaurus may have used its sail to control its body temperature. After the chilly night, it would stand side-on to the sun, and take in heat through the large area of the sail. This would warm it quickly, so it was ready for action early. If it felt too hot, it could stand in a shady place side-on to the breeze to cool down.

FIRST INTO ACTION

Spinosaurus lived at about the same time, 100 million years ago. This large meat-eater also had a sail nearly 2m tall. Like *Ouranosaurus*, it may have used the sail to warm up quickly after the chill of the night. In the same way as the early bird catches the worm, the early *Spinosaurus* caught its prey.

Today, fennec foxes use their enormous ears to cool themselves in the same way as *Ouranosaurus* cooled itself with its sail millions of years ago.

DESERT SURVIVAL

Today, most desert animals avoid the heat by burrowing into the ground or lying in the shade under rocks. Some have huge ears, like the fennec fox. These work like *Ouranosaurus'* sail, and can help get rid of unwanted body heat. Others burrow underground and stay inactive for weeks, until there is a rare rainstorm, and life briefly bursts into action. Coping with a dry period like this is called aestivation.

MYSTERY OF THE TEETH

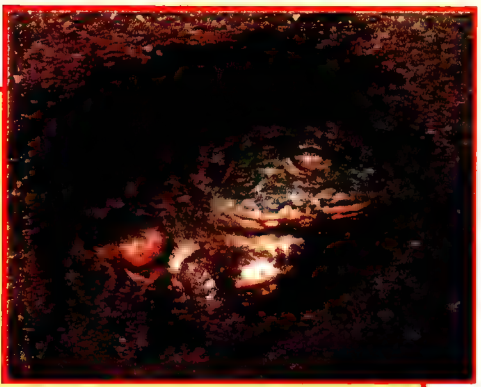
Lesothosaurus was a tiny, two-legged dinosaur which lived in Africa 195 million years ago. The fossils of several dinosaurs were found together in the red sandstone of the Red Beds, South Africa. The sandstone shows that the area was probably a desert. *Lesothosaurus* had tiny teeth for shredding leaves. Some of the fossil jaw bones had sharp, new teeth. Nearby, there were very worn teeth. Why?

SLEEPING THROUGH THE DROUGHT?

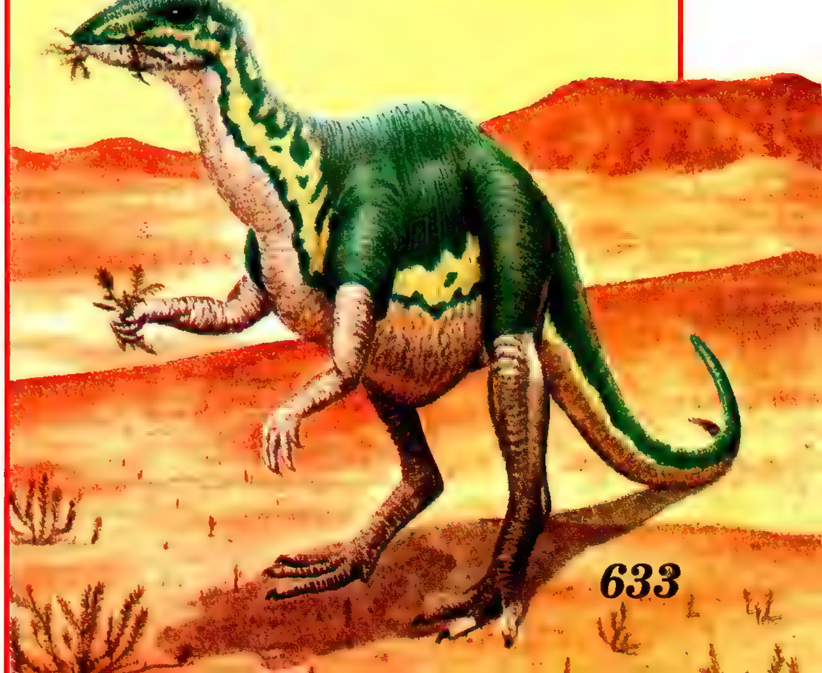
Some scientists think these dinosaurs may have slept, or aestivated, during the long dry season. During this time they may have shed their old teeth and grown new ones, ready to tackle next year's plant growth. By some accident, a group of aestivating *Lesothosaurus* could have been buried and preserved.

What is? AESTIVATION

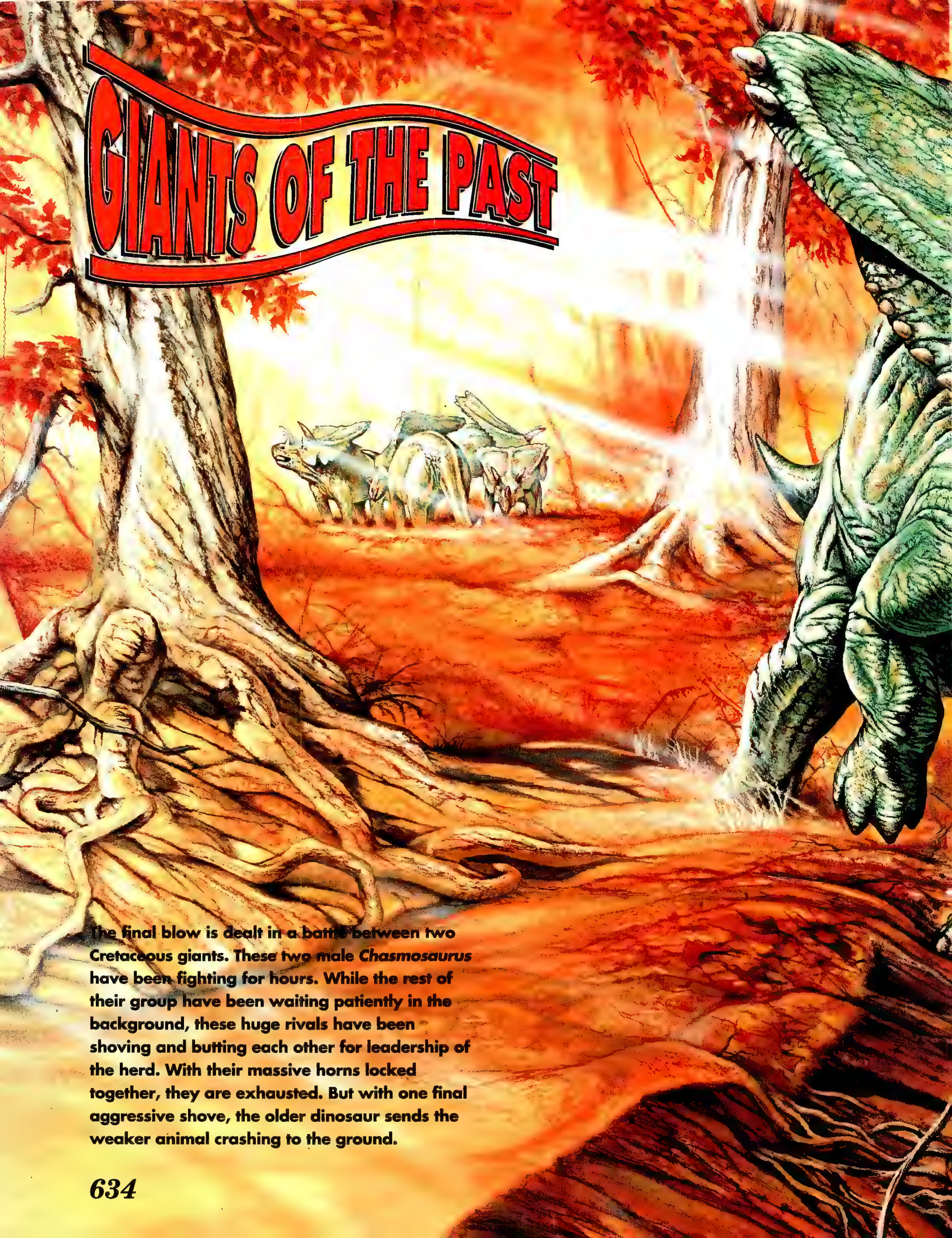
When animals have to survive a very dry period, some become completely inactive for weeks, or even months, at a time. This is called aestivation. It is similar to winter hibernation, when animals sleep through a cold period. Some animals burrow underground to aestivate. When the dry period has ended and the rains arrive, they become active again and return to their usual way of life. Many animals aestivate today, including earthworms, which bury themselves deep in the soil; snails, which seal off the entrances to their shells with a solid plug, and some ants, flies, bees and beetles.



An Australian water-holding frog (right) emerges from its sandy burrow after a period of aestivation. *Lesothosaurus* (below) was a two-legged dinosaur which may have lived in the desert. Some scientists think it may have aestivated during periods of drought.



GIANTS OF THE PAST



The final blow is dealt in a battle between two Cretaceous giants. These two male *Chasmosaurus* have been fighting for hours. While the rest of their group have been waiting patiently in the background, these huge rivals have been shoving and butting each other for leadership of the herd. With their massive horns locked together, they are exhausted. But with one final aggressive shove, the older dinosaur sends the weaker animal crashing to the ground.

CHASMOSAURUS

3-D Gallery

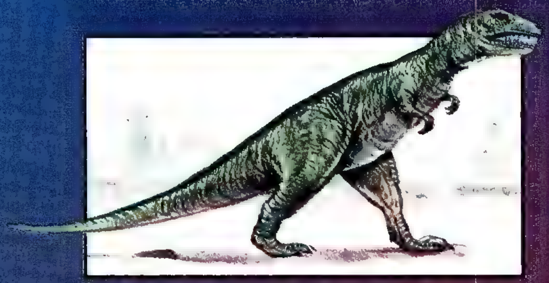
MAMENCHISAURUS

- A long-necked sauropod
- Lived about 145 million years ago in China
- Measured 22m long
- Ate plants

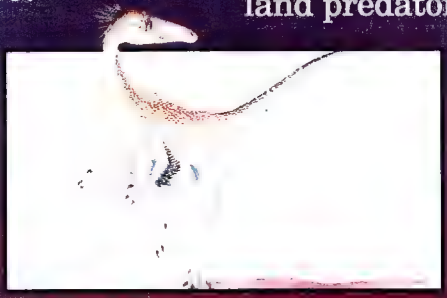
Masses of meat-eaters

Some killed massive sauropods, others went for lizards or a crunchy insect. Some liked fish and others relished rotting meat. Run for cover – here are the blood-thirsty meat-eaters!

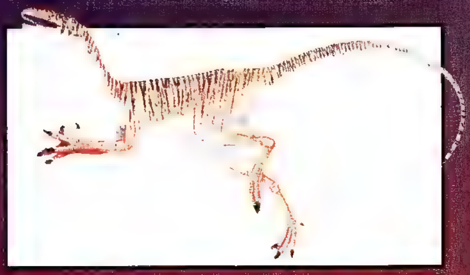
Some of the very smallest dinosaurs were meat-eaters. *Saltopus* was only 60cm long. *T rex*, on the other hand, was 19 times heavier than the heaviest living land predator, the Siberian tiger (300kg).



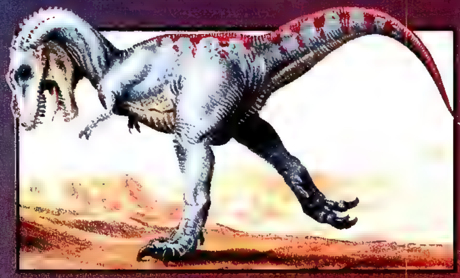
Name: ***Allosaurus***
Family: **Allosaurid**
Size: **12m long**
Lived: **Late Jurassic**



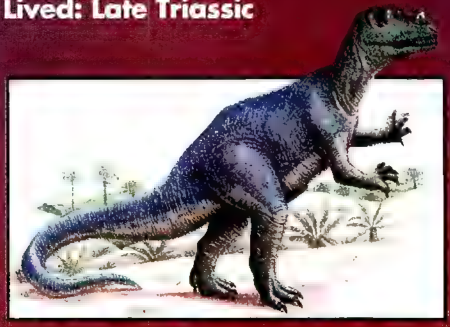
Name: ***Syntarsus***
Family: **Ceratosaurid**
Size: **3m long**
Lived: **Late Triassic**



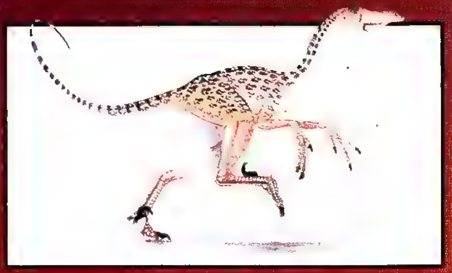
Name: ***Coelurus***
Family: **Coelurid**
Size: **2m long**
Lived: **Late Jurassic**



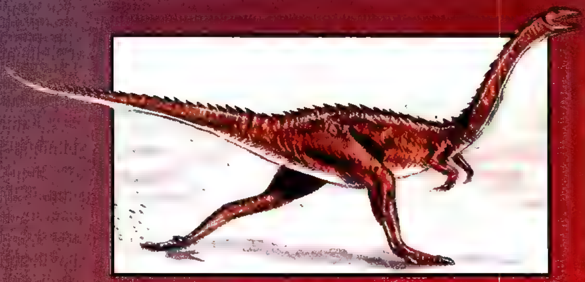
Name: ***Tarbosaurus***
Family: **Tyrannosaurid**
Size: **12m long**
Lived: **Late Cretaceous**



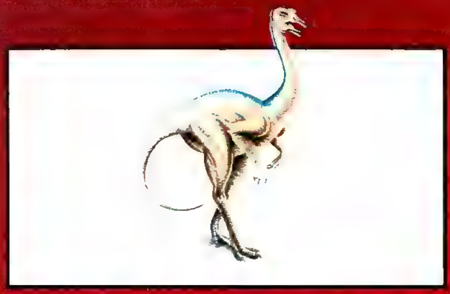
Name: ***Ceratosaurus***
Family: **Ceratosaurid**
Size: **6m long**
Lived: **Late Jurassic**



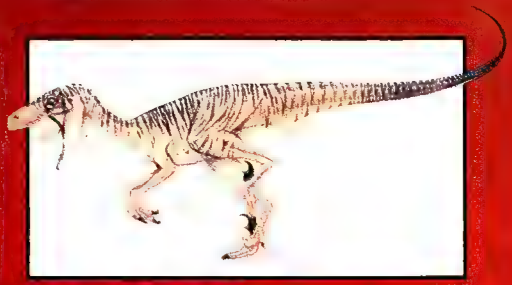
Name: ***Velociraptor***
Family: **Dromaeosaurid**
Size: **1.8m long**
Lived: **Mid Cretaceous**



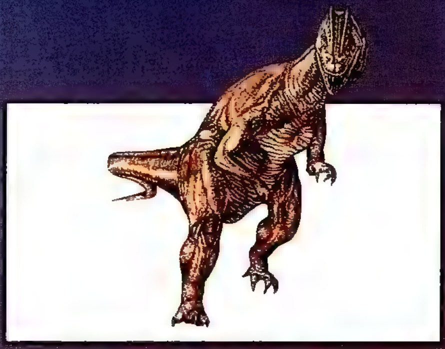
Name: ***Gallimimus***
Family: **Ornithomimosaur**
Size: **4m long**
Lived: **Late Cretaceous**



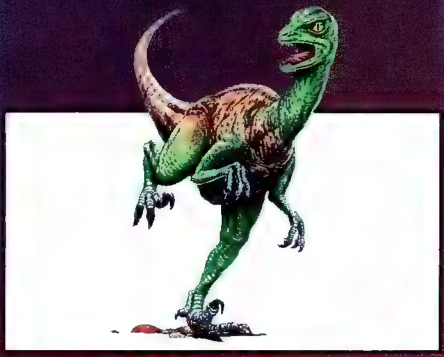
Name: ***Deinocheirus***
Family: **Ornithomimosaur**
Size: **Up to 15m long**
Lived: **Late Cretaceous**



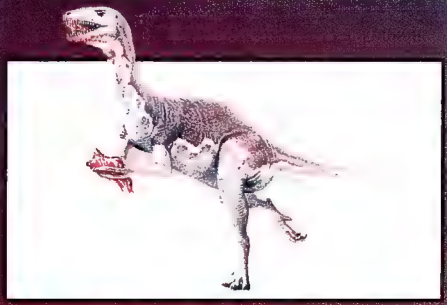
Name: ***Deinonychus***
Family: **Dromaeosaurid**
Size: **3m long**
Lived: **Mid Cretaceous**



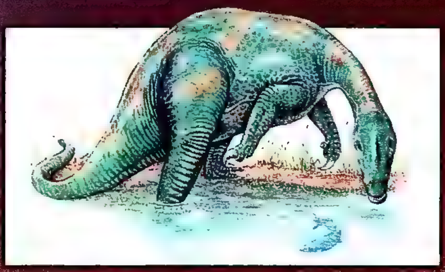
Name: *Dilophosaurus*
Family: Ceratosaurid
Size: 6m long
Lived: Early Jurassic



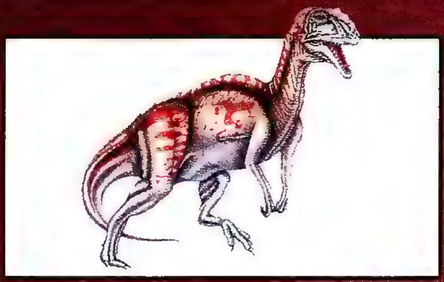
Name: *Troodon*
Family: Troodontid
Size: 2.4m long
Lived: Late Cretaceous



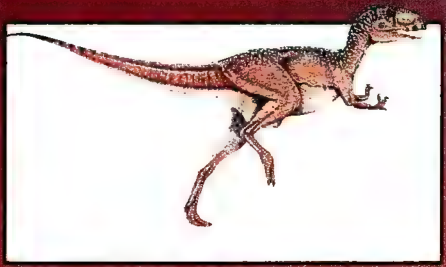
Name: *Ornitholestes*
Family: Coelurosaurid
Size: 2m long
Lived: Late Jurassic



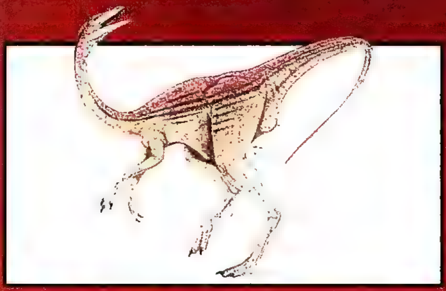
Name: *Baryonyx*
Family: Baryonychid
Size: 9m long
Lived: Late Jurassic



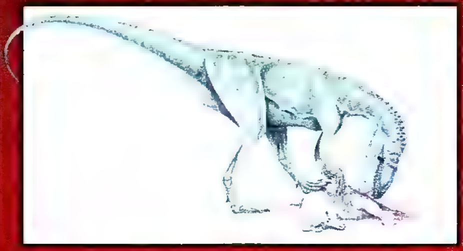
Name: *Yangchuanosaurus*
Family: Allosaurid
Size: 10m long
Lived: Late Jurassic



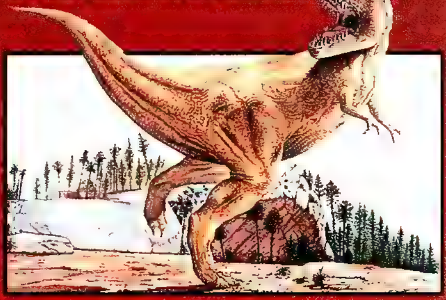
Name: *Abelisaurus*
Family: Abelisaurid
Size: 6.5m long
Lived: Late Cretaceous



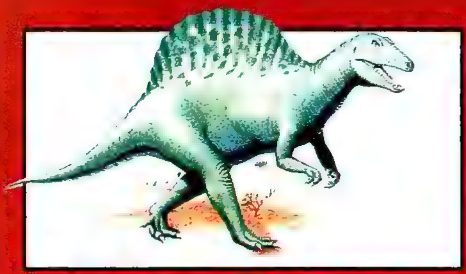
Name: *Struthiomimus*
Family: Ornithomimosaur
Size: 3 – 4m long
Lived: Late Cretaceous



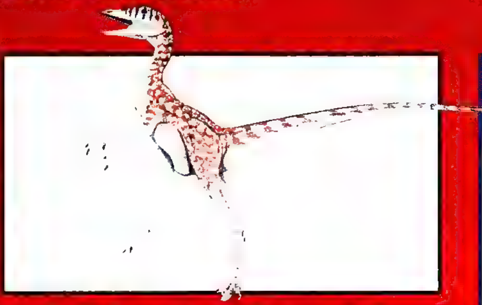
Name: *Herrerasaurus*
Family: Herrerasaurid
Size: 3m long
Lived: Late Triassic



Name: *T rex*
Family: Tyrannosaurid
Size: 14m long
Lived: Late Cretaceous



Name: *Spinosaurus*
Family: Spinosaurid
Size: 10 – 12m long
Lived: Mid Cretaceous



Name: *Saltopus*
Family: Coelurid
Size: 60cm
Lived: Late Cretaceous

KEY

Triassic: 245 – 204 million years ago

Jurassic: 204 – 140 million years ago

Cretaceous: 140 – 66 million years ago

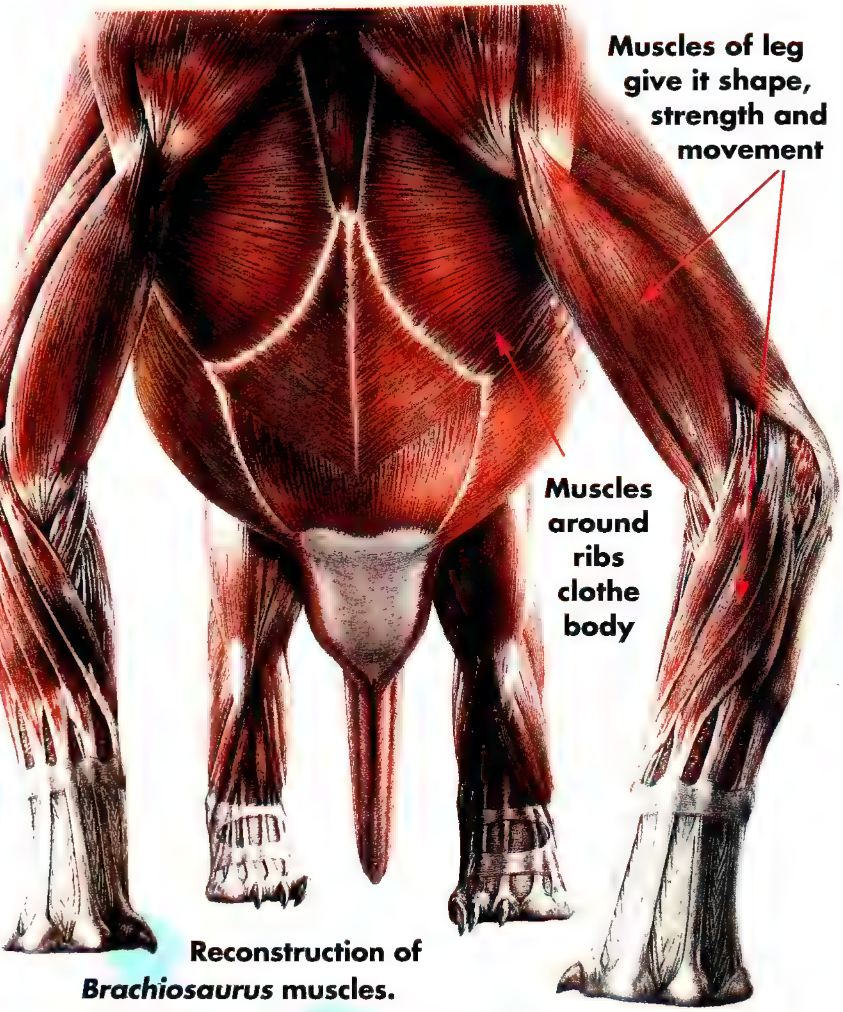
Bringing dinosaurs to life

To find out what a dinosaur looked like, scientists must reconstruct its muscles.

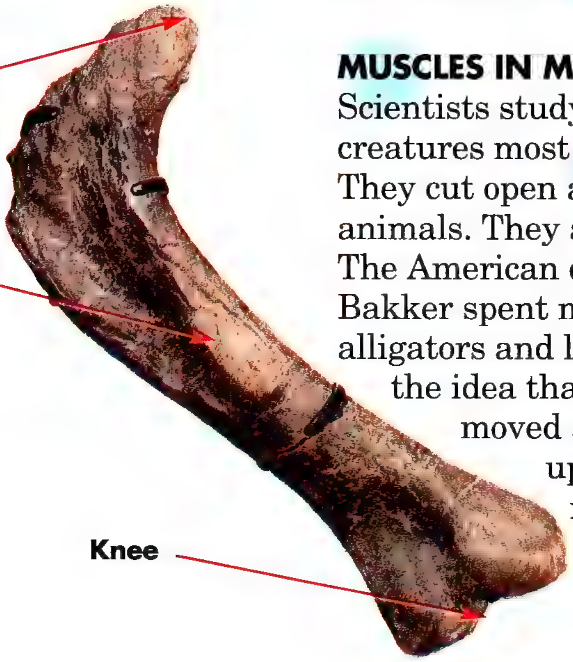
Discovering where a dinosaur's muscles were fixed to the bones of its skeleton is a vital clue to what the animal was like. The muscles of a dinosaur not only held its bones together and gave its body shape, they also made it move.

MUSCLE POWER

Dinosaur muscles have not survived, but the scars showing where they were attached to fossil bones can still be seen. The fossil bones have rough places, or ridges, where muscles were once attached. Scientists studying them can work out what the missing muscles must have been like.


Muscles of leg give it shape, strength and movement
Muscles around ribs clothe body

Reconstruction of *Brachiosaurus* muscles. Scientists work out muscle positions from scars left on bones.



The light patch is a muscle scar. It is where the muscle was once attached to this *Apatosaurus* thigh bone.

MUSCLES IN MOTION

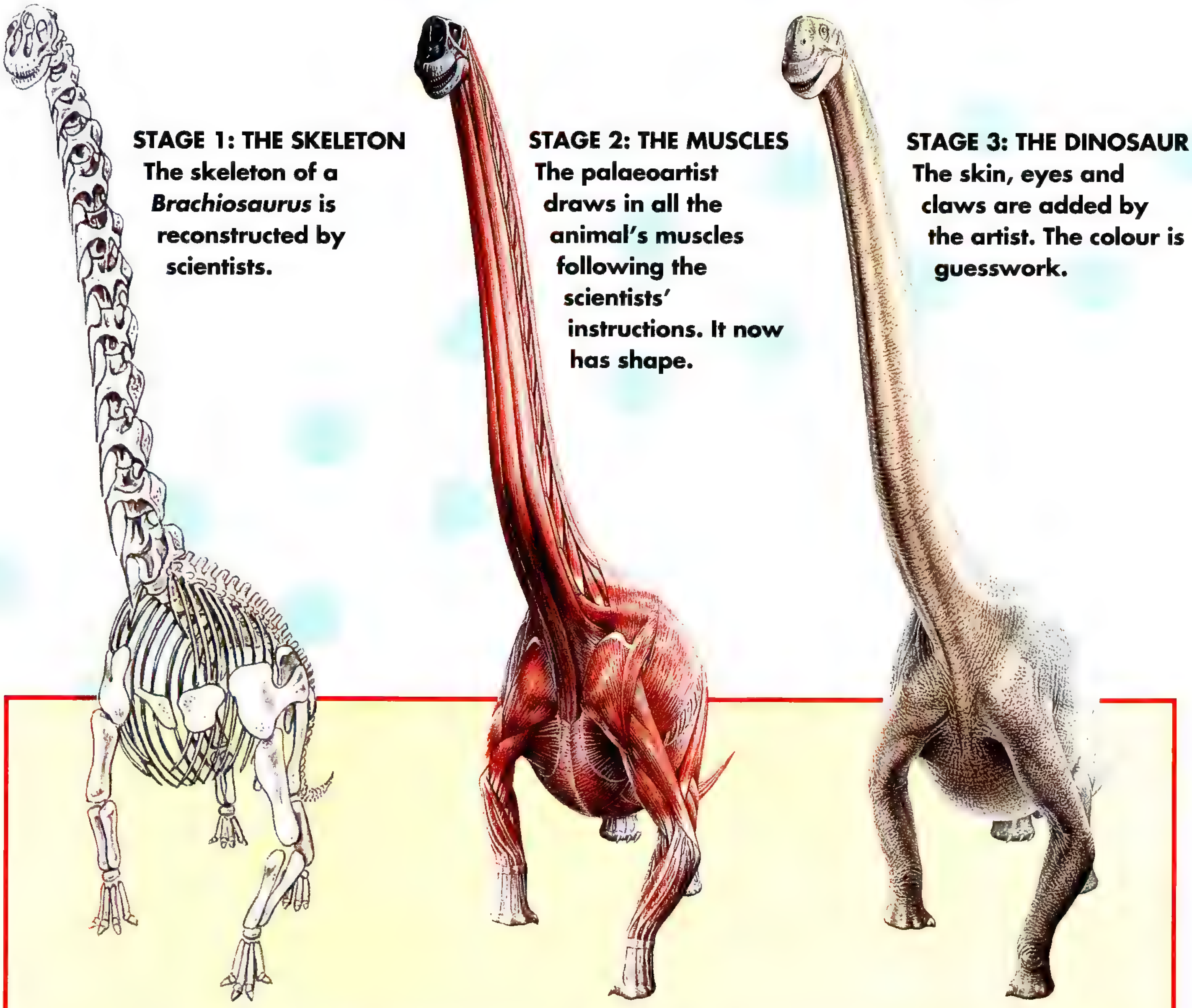
Scientists study the muscles of modern creatures most closely related to dinosaurs. They cut open and study the bodies of dead animals. They also watch creatures move. The American dinosaur expert Robert Bakker spent many hours filming alligators and lizards. His work supported the idea that dinosaurs must have moved about in a much more upright way than most modern reptiles.

TAKING SHAPE

Adding muscles to a dinosaur skeleton shows how it moved. It also provides the first clear picture of what the animal might have looked like. This stage of a reconstruction is often shown as a drawing or painting. It is produced by a special artist who works closely with the palaeontologist in charge. He, or she, is called a palaeoartist. Palaeoartists study the muscle layer of a dinosaur's closest living relatives. That helps them to make their reconstruction as lifelike as possible.

What is? A MUSCLE

All animals (and human beings) use their muscles to move. Muscles are made up of long, thin fibres that are attached to the bones by cord-like strips of extra-tough tissue called tendons. On fossilized dinosaur bones tendons left clear scars at the point where they were attached to bones. Limb muscles often work in pairs, so that when the muscle at the front of a limb is tensed, the one at the back relaxes.



STAGE 1: THE SKELETON
The skeleton of a *Brachiosaurus* is reconstructed by scientists.

STAGE 2: THE MUSCLES
The palaeoartist draws in all the animal's muscles following the scientists' instructions. It now has shape.

STAGE 3: THE DINOSAUR
The skin, eyes and claws are added by the artist. The colour is guesswork.

How a dinosaur is brought to life by a palaeoartist.

GALLOPING GIANTS

Discoveries about missing muscles can tell us about how fast, or slowly, a dinosaur moved. Some dinosaurs had knee joints with bulging bony ridges where the muscles joined. The large size of the ridges meant that the muscles there must have been extra strong. Modern rhinos have similar bulging ridges around their knee joints. They use their powerful knee muscles to support their heavy bodies when they gallop along. Experts believe that dinosaurs with similar knee joints must have run as fast.

LUMBERING ALONG

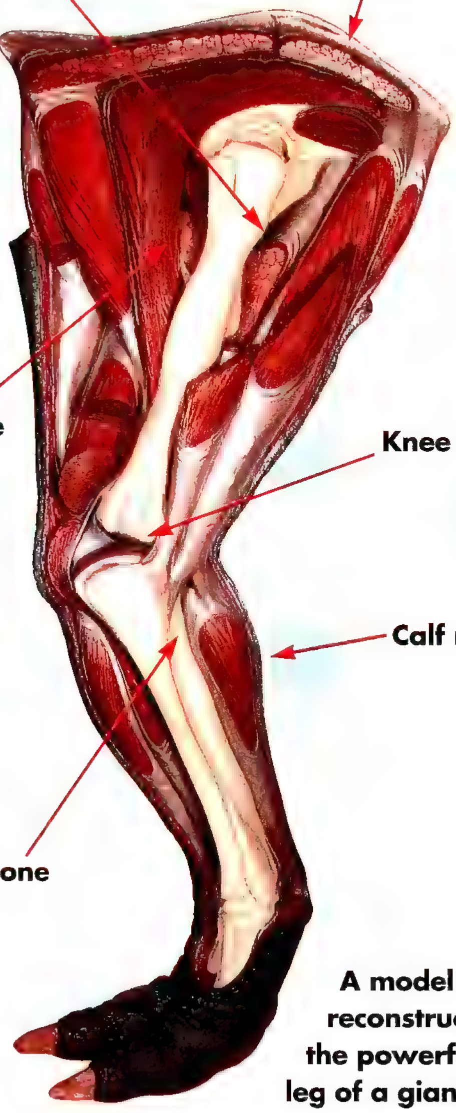
Some dinosaurs had powerful 'bouncy' knee joints like rhinos. Others, with stiffer knee joints more like a modern elephant's, must have moved more slowly.

BONING UP

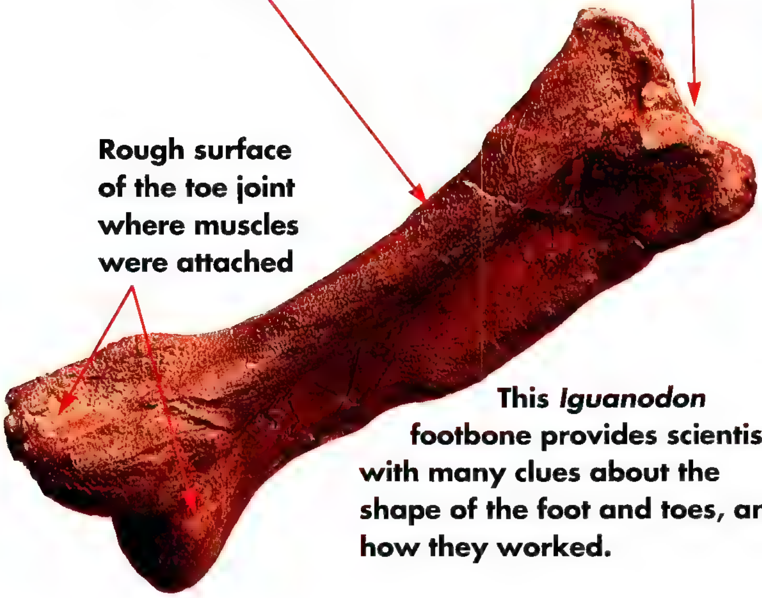
Experts studying the marks of the muscles and tendons on the footbones of three-toed *Iguanodon* think that the dinosaur probably walked on its toes, like modern dogs and cats.

Is it true that *Tyrannosaurus rex* was a fast runner?

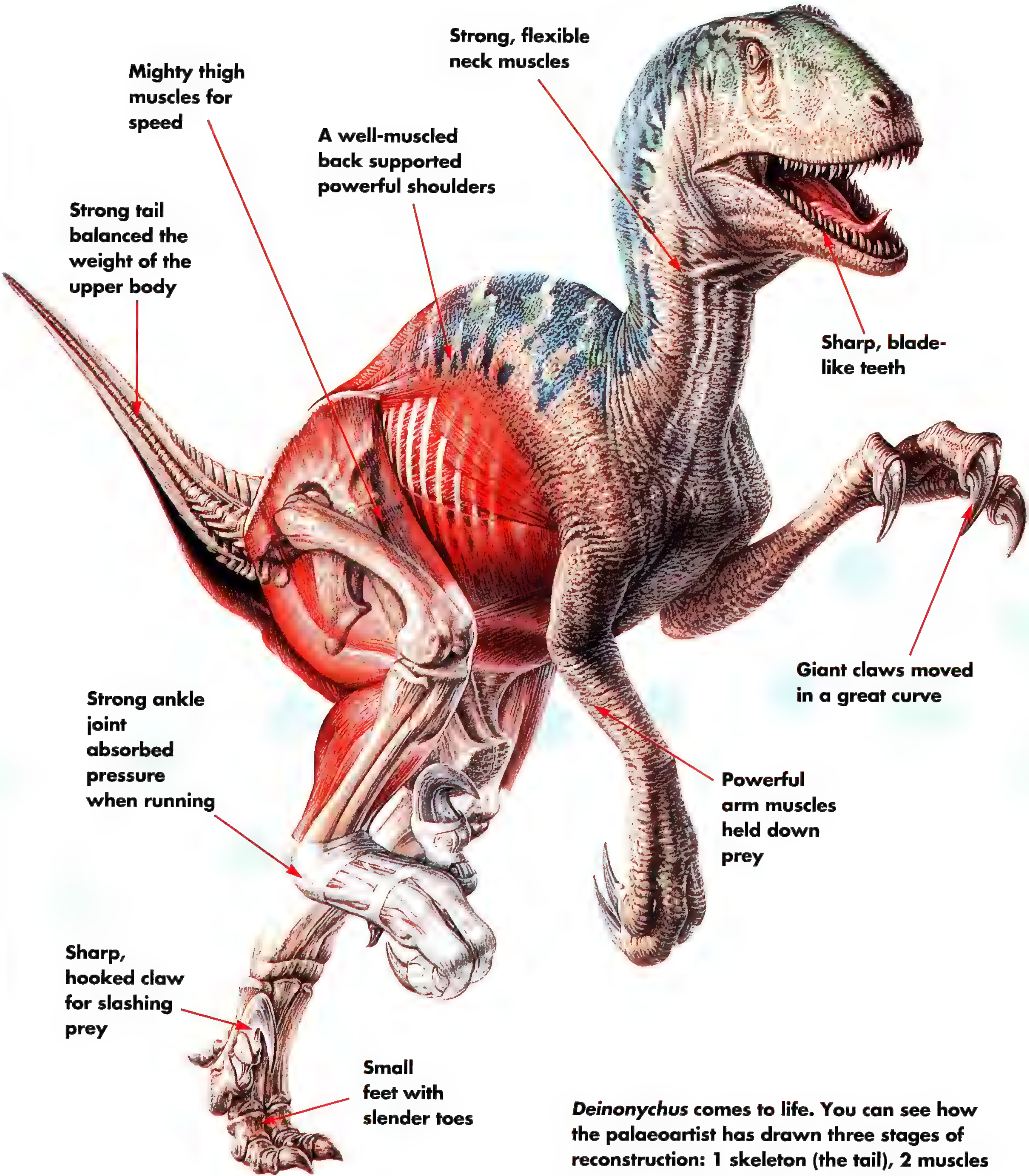
Tyrannosaurus rex skeletons have large, bony ridges around their knee joints. This means the dinosaur must have had very powerful leg muscles. Experts think that meat-eaters like *Tyrannosaurus* and *Albertosaurus* sprinted in short bursts at speeds of up to 45km/h when they were running down prey. But they could not have kept up that speed for long.



A model reconstruction of the powerful hind leg of a giant plant-eating *Iguanodon*.

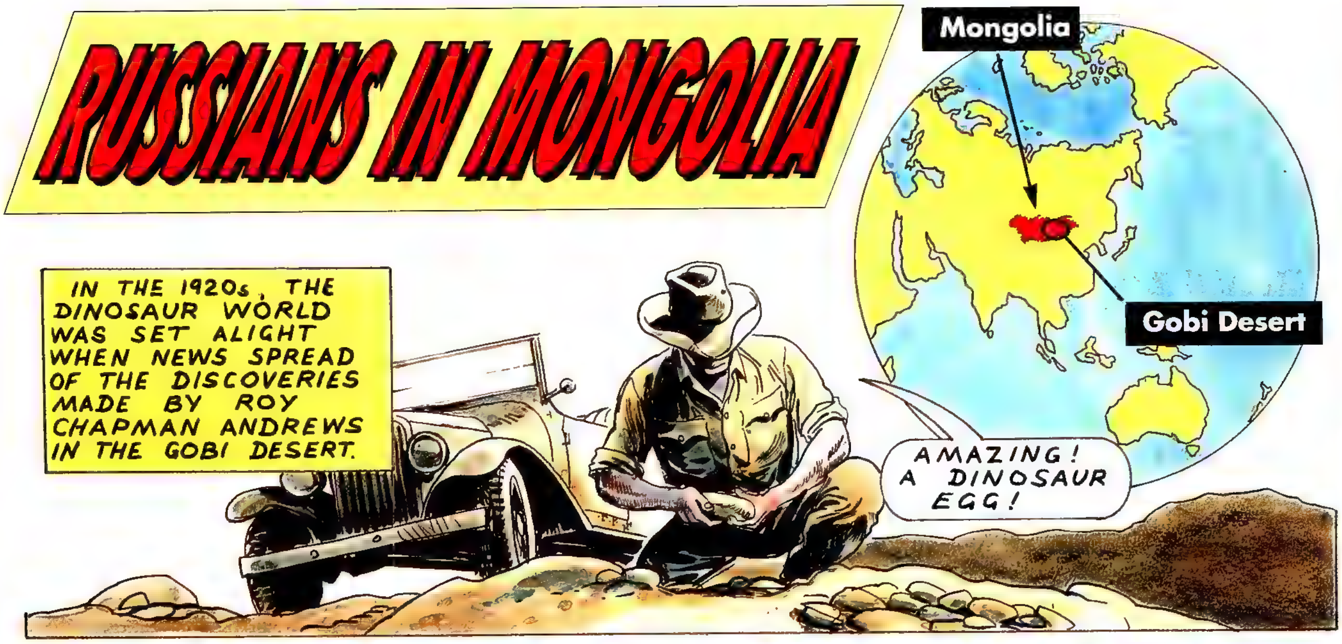

Strong shaft
Rough surface of the ankle joint where muscles were attached
Rough surface of the toe joint where muscles were attached

This *Iguanodon* footbone provides scientists with many clues about the shape of the foot and toes, and how they worked.


Mighty thigh muscles for speed
Strong, flexible neck muscles
A well-muscled back supported powerful shoulders
Strong tail balanced the weight of the upper body
Sharp, blade-like teeth
Giant claws moved in a great curve
Strong ankle joint absorbed pressure when running
Powerful arm muscles held down prey
Sharp, hooked claw for slashing prey
Small feet with slender toes

Deinonychus comes to life. You can see how the palaeoartist has drawn three stages of reconstruction: 1 skeleton (the tail), 2 muscles (the legs), 3 skin (the chest and head).

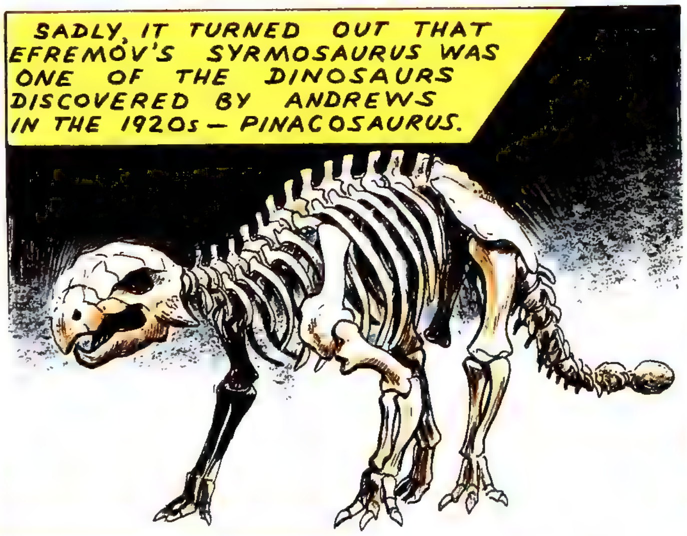
RUSSIANS IN MONGOLIA



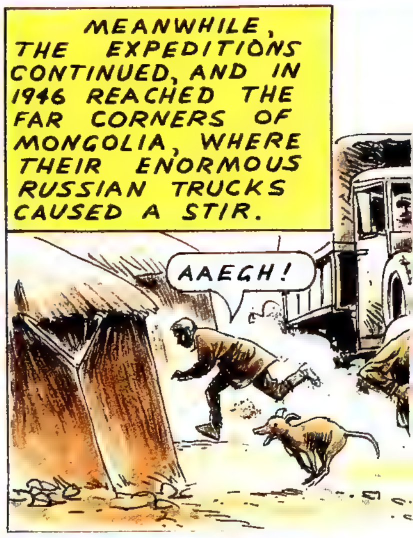
IN THE 1920s, THE DINOSAUR WORLD WAS SET ALIGHT WHEN NEWS SPREAD OF THE DISCOVERIES MADE BY ROY CHAPMAN ANDREWS IN THE GOBI DESERT.

LATER, AFTER THE EXPEDITION HAD RETURNED TO MOSCOW, EFREMOV WAS ABLE TO EXAMINE THE NEW FOSSILS THOROUGHLY.

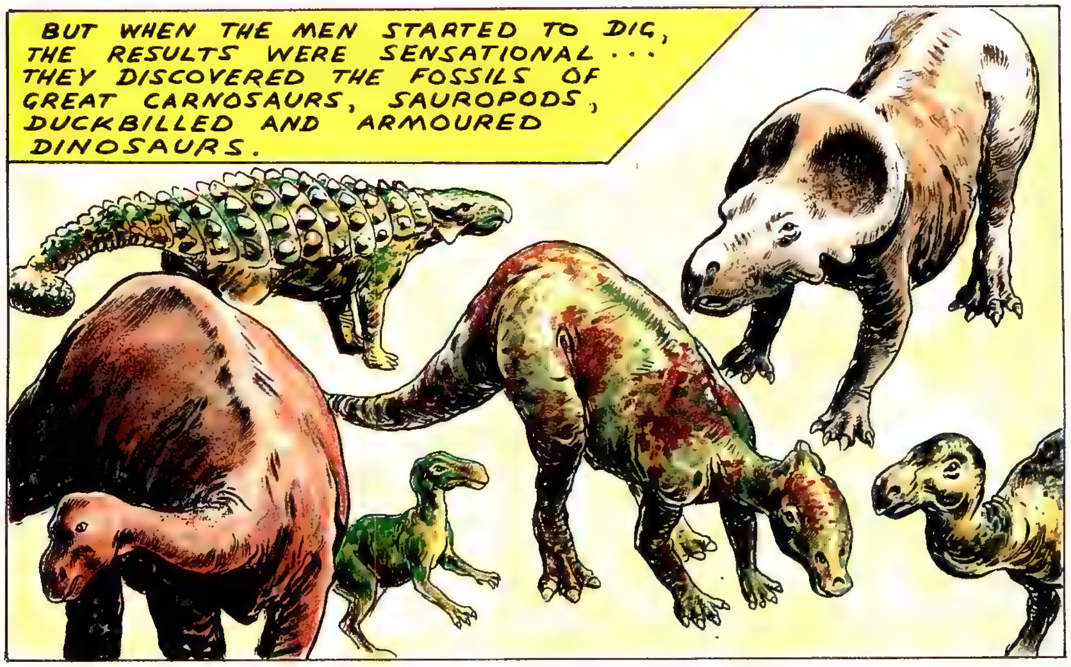
I SHALL CALL IT SYRMOSAURUS!



SADLY, IT TURNED OUT THAT EFREMOV'S SYRMOSAURUS WAS ONE OF THE DINOSAURS DISCOVERED BY ANDREWS IN THE 1920s — PINACOSAURUS.



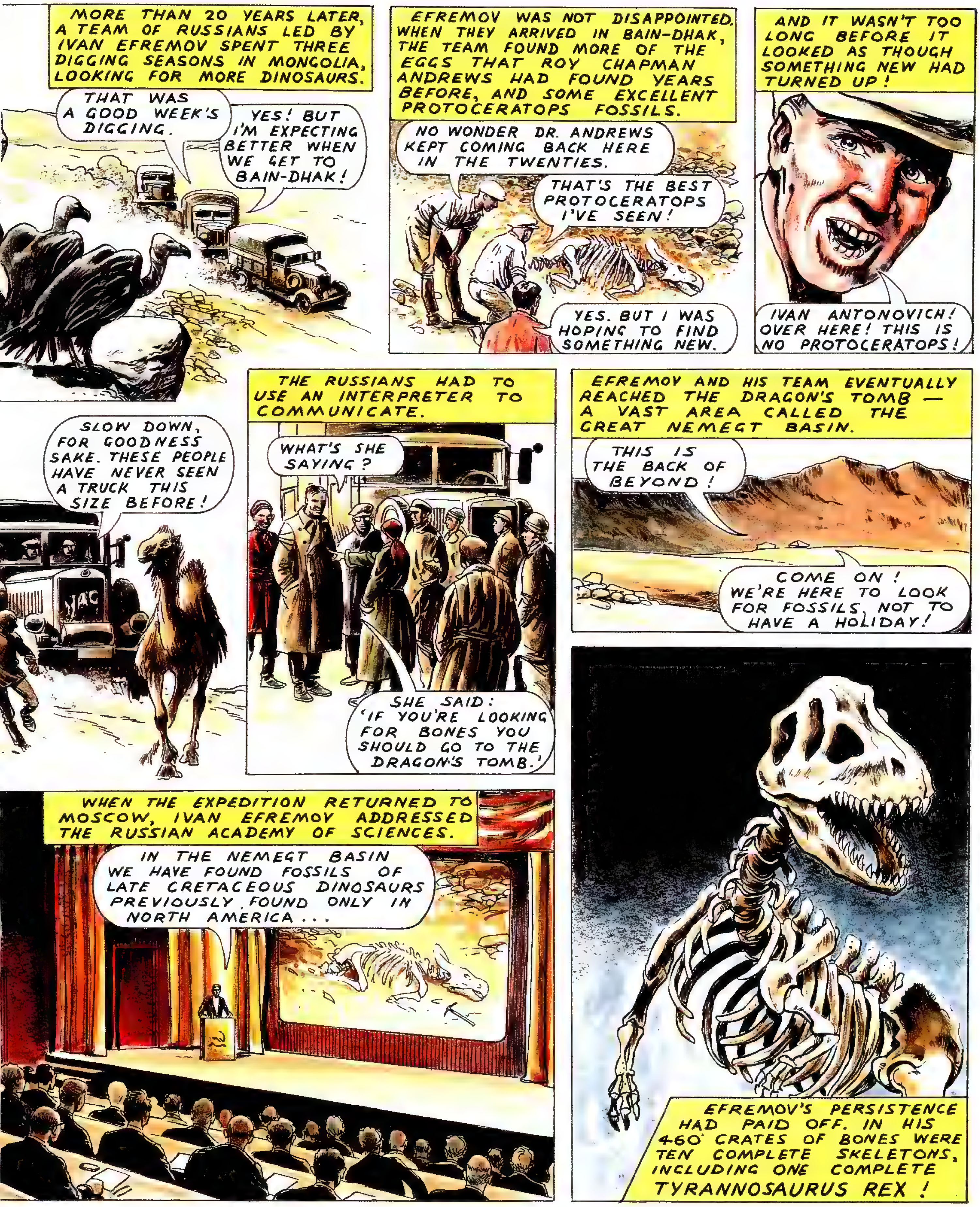
MEANWHILE, THE EXPEDITIONS CONTINUED, AND IN 1946 REACHED THE FAR CORNERS OF MONGOLIA, WHERE THEIR ENORMOUS RUSSIAN TRUCKS CAUSED A STIR.



BUT WHEN THE MEN STARTED TO DIG, THE RESULTS WERE SENSATIONAL ... THEY DISCOVERED THE FOSSILS OF GREAT CARNOSAURS, SAUROPODS, DUCKBILLED AND ARMOURED DINOSAURS.

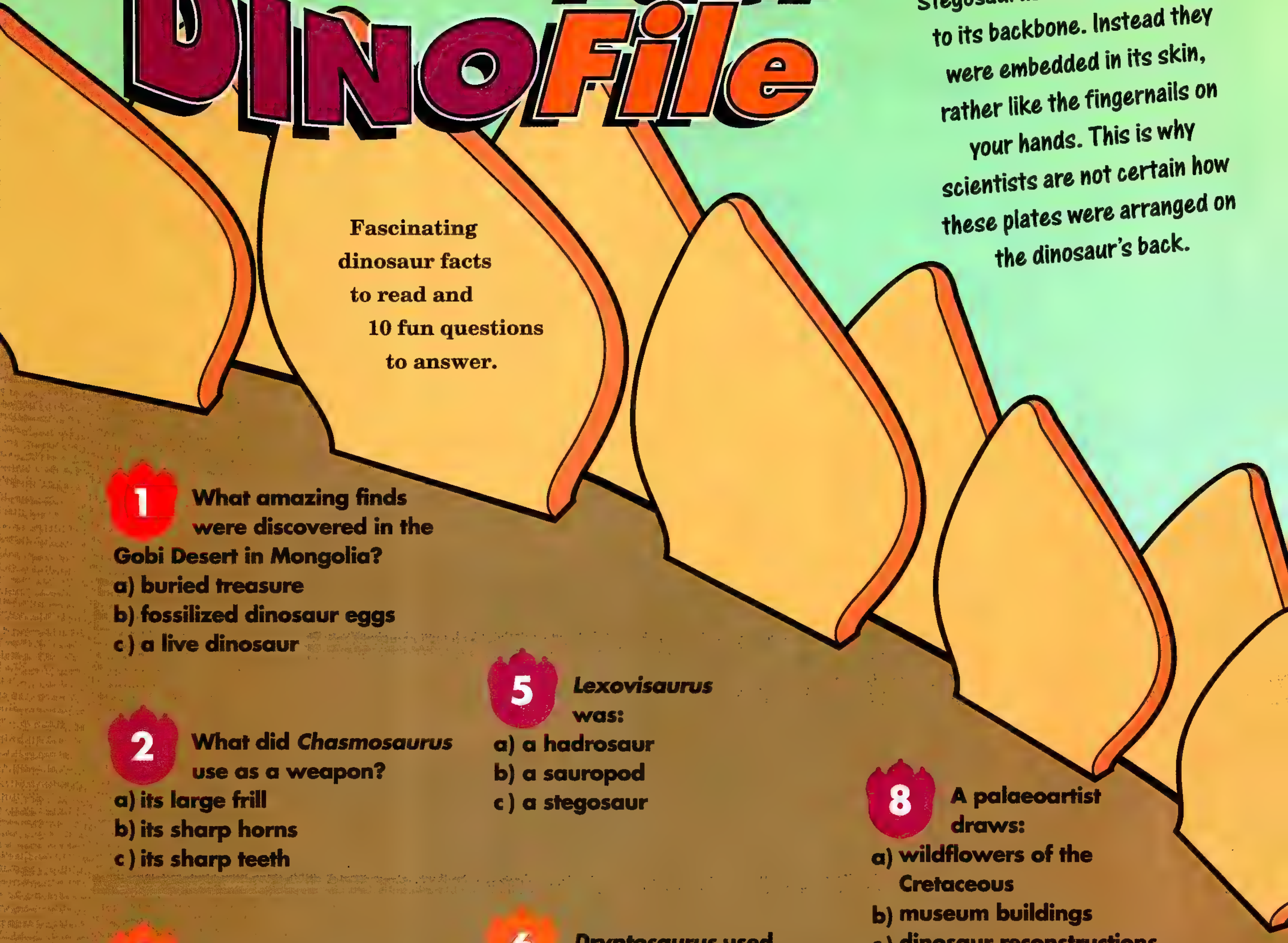
BY THE TIME THE EXPEDITION WAS OVER, 120 TONNES OF FOSSIL BONES, INCLUDING TEN COMPLETE SKELETONS WERE TAKEN BACK TO RUSSIA IN 460 CRATES.

THANK GOODNESS THIS IS THE LAST BATCH.
YES! I HOPE WE GET THEM ALL BACK TO MOSCOW IN ONE PIECE!


MORE THAN 20 YEARS LATER, A TEAM OF RUSSIANS LED BY IVAN EFREMOV SPENT THREE DIGGING SEASONS IN MONGOLIA, LOOKING FOR MORE DINOSAURS.
THAT WAS A GOOD WEEK'S DIGGING.
YES! BUT I'M EXPECTING BETTER WHEN WE GET TO BAIN-DHAK!
EFREMOV WAS NOT DISAPPOINTED. WHEN THEY ARRIVED IN BAIN-DHAK, THE TEAM FOUND MORE OF THE EGGS THAT ROY CHAPMAN ANDREWS HAD FOUND YEARS BEFORE, AND SOME EXCELLENT PROTOCERATOPS FOSSILS.
NO WONDER DR. ANDREWS KEPT COMING BACK HERE IN THE TWENTIES.
THAT'S THE BEST PROTOCERATOPS I'VE SEEN!
YES. BUT I WAS HOPING TO FIND SOMETHING NEW.
AND IT WASN'T TOO LONG BEFORE IT LOOKED AS THOUGH SOMETHING NEW HAD TURNED UP!
IVAN ANTONOVICH! OVER HERE! THIS IS NO PROTOCERATOPS!
SLOW DOWN, FOR GOODNESS SAKE. THESE PEOPLE HAVE NEVER SEEN A TRUCK THIS SIZE BEFORE!
YAC
THE RUSSIANS HAD TO USE AN INTERPRETER TO COMMUNICATE.
WHAT'S SHE SAYING?
SHE SAID: 'IF YOU'RE LOOKING FOR BONES YOU SHOULD GO TO THE DRAGON'S TOMB.'
EFREMOV AND HIS TEAM EVENTUALLY REACHED THE DRAGON'S TOMB — A VAST AREA CALLED THE GREAT NEMEGT BASIN.
THIS IS THE BACK OF BEYOND!
COME ON! WE'RE HERE TO LOOK FOR FOSSILS, NOT TO HAVE A HOLIDAY!
WHEN THE EXPEDITION RETURNED TO MOSCOW, IVAN EFREMOV ADDRESSED THE RUSSIAN ACADEMY OF SCIENCES.
IN THE NEMEGT BASIN WE HAVE FOUND FOSSILS OF LATE CRETACEOUS DINOSAURS PREVIOUSLY FOUND ONLY IN NORTH AMERICA...
EFREMOV'S PERSISTENCE HAD PAID OFF. IN HIS 460 CRATES OF BONES WERE TEN COMPLETE SKELETONS, INCLUDING ONE COMPLETE TYRANNOSAURUS REX!

Improve and test your knowledge with...

DINO Fact File



Fascinating dinosaur facts to read and 10 fun questions to answer.

Scientific guesswork

The large plates on the back of *Stegosaurus* were not attached to its backbone. Instead they were embedded in its skin, rather like the fingernails on your hands. This is why scientists are not certain how these plates were arranged on the dinosaur's back.

1 What amazing finds were discovered in the Gobi Desert in Mongolia?
a) buried treasure
b) fossilized dinosaur eggs
c) a live dinosaur

2 What did *Chasmosaurus* use as a weapon?
a) its large frill
b) its sharp horns
c) its sharp teeth

3 How big was the biggest meat-eating dinosaur?
a) 14m
b) 34m
c) 2m

4 Which complete dinosaur did Efremov find?
a) *Tatisaurus*
b) *Technosaurus*
c) *T rex*

5 *Lexovisaurus* was:
a) a hadrosaur
b) a sauropod
c) a stegosaur

6 *Dryptosaurus* used to be called:
a) *Laelaps*
b) *Leaellynasaura*
c) *Leptoceratops*

7 What sort of dinosaur was *Thecodontosaurus?*
a) a small plant-eater
b) a medium meat-eater
c) a large plant-eater

8 A palaeoartist draws:
a) wildflowers of the Cretaceous
b) museum buildings
c) dinosaur reconstructions

9 *Chasmosaurus* lived:
a) on its own
b) in pairs
c) in herds

Talking chalk

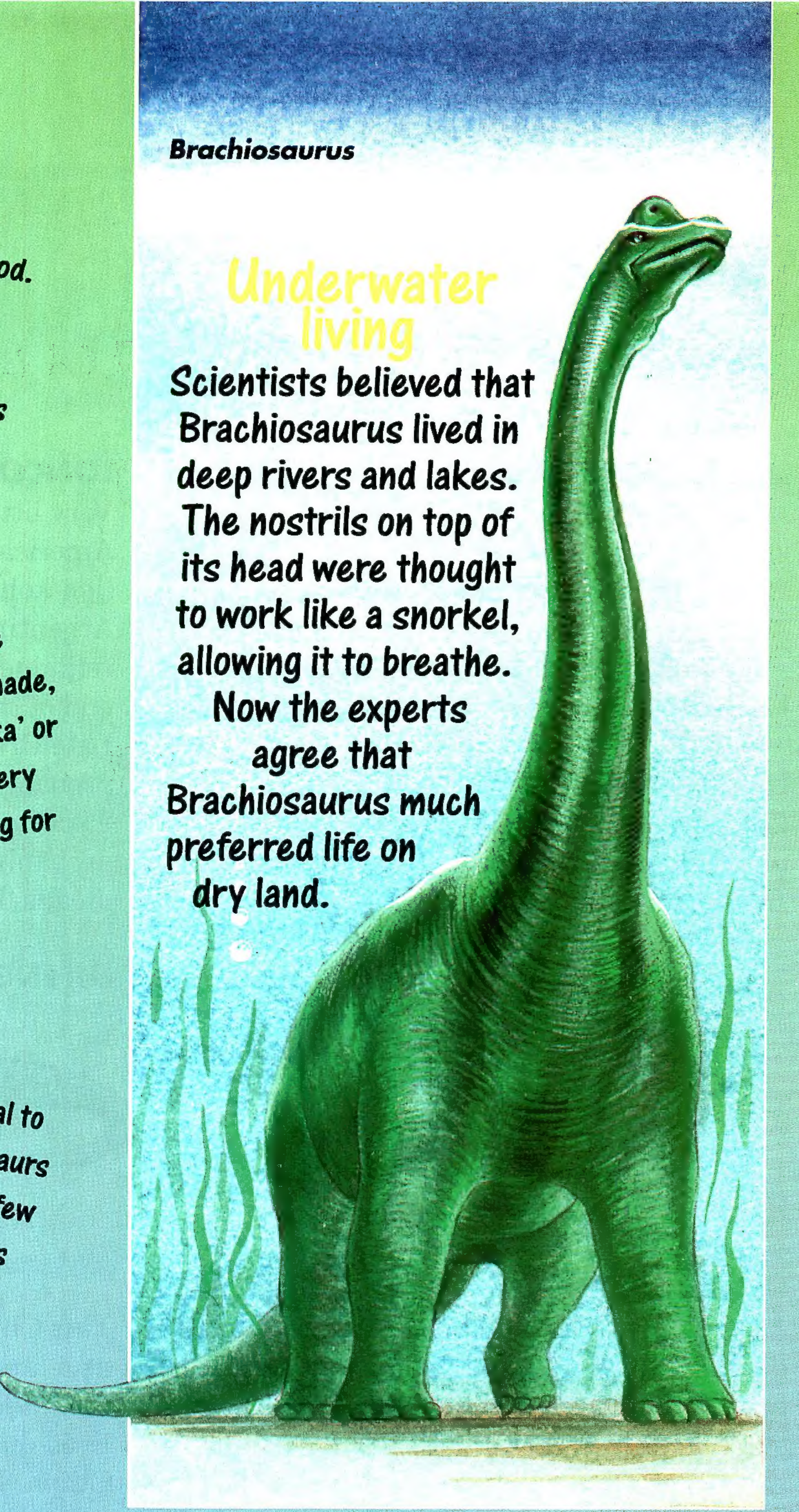
The last and the longest period of the Dinosaur Age is called the Cretaceous Period. It lasted for 74 million years. The name Cretaceous comes from the Latin word 'creta', which means chalk. The chalky layers of rock laid down during this time built up on the beds of shallow Cretaceous seas.

Bad land

The Badlands of Alberta, in Canada, where hundreds of dinosaur discoveries have been made, were known to the Sioux Indians as 'Mako Sika' or 'land bad'. The dry plains in this area are very difficult to cross – which made it tough going for early fossil hunters.

Sick dinos

Cancer is an illness that can be fatal to humans. Millions of years ago, dinosaurs were also victims of this disease. A few years ago a duckbilled dinosaur was found which had a cancerous lump in its back bone.



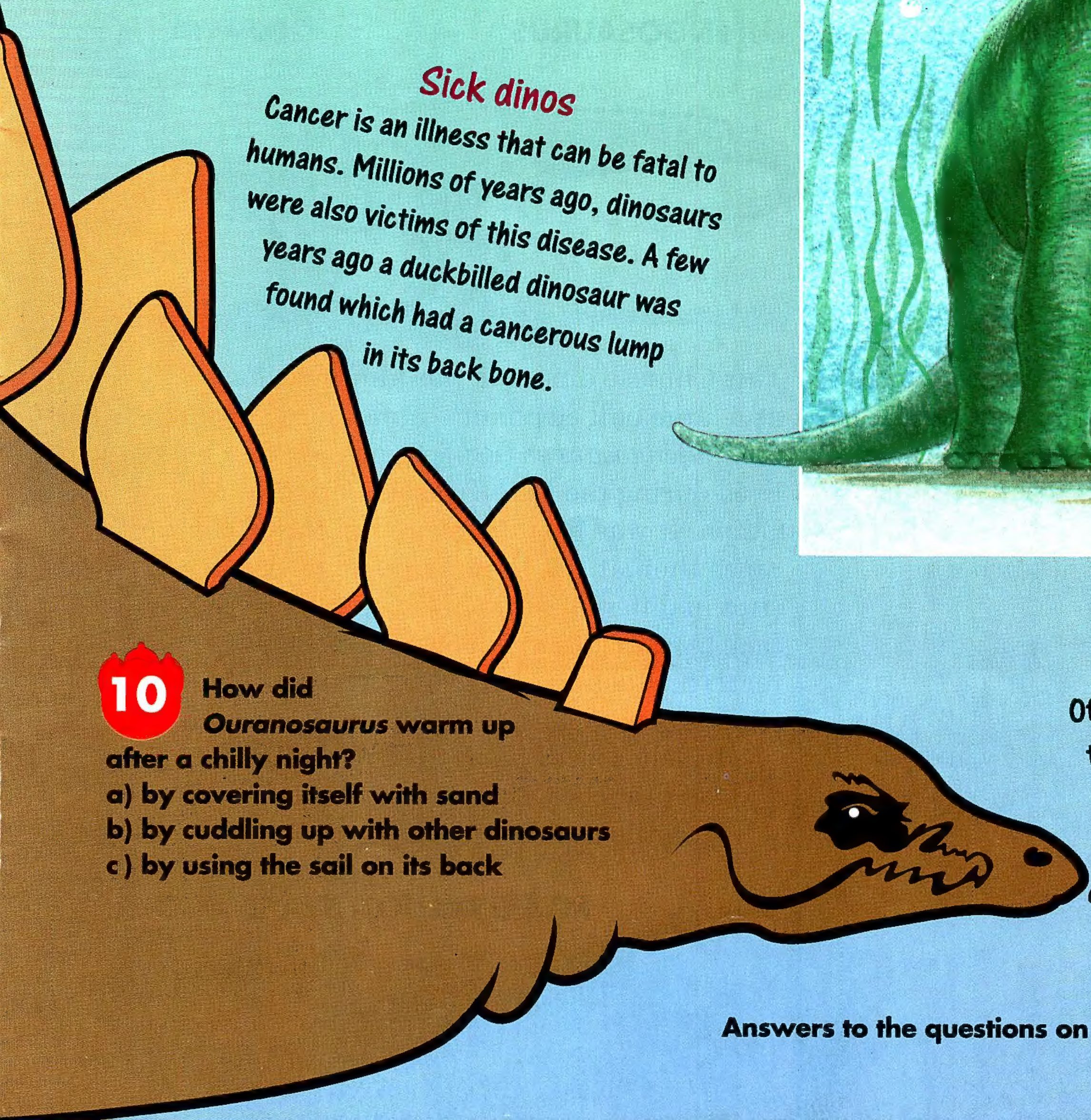
Brachiosaurus

Underwater living

Scientists believed that Brachiosaurus lived in deep rivers and lakes. The nostrils on top of its head were thought to work like a snorkel, allowing it to breathe. Now the experts agree that Brachiosaurus much preferred life on dry land.

Indestructible!

Of all the dinosaur remains found, the teeth, which are the hardest part of the skeleton, usually survive best. When they are found the teeth are exactly the same as when the dinosaur last used them.



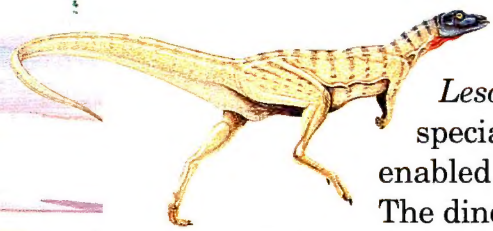
10 **How did *Ouranosaurus* warm up after a chilly night?**
- **a) by covering itself with sand**
- **b) by cuddling up with other dinosaurs**
- **c) by using the sail on its back**

LEAELLYNASAURA 105 MYA

Leaellynasaura (lee-ellen-a-saw-ra) was a small, speedy plant-eater. It lived in the Early Cretaceous Period in Victoria, Australia. *Leaellynasaura* was named after a little girl called Leaellyn. It was 60cm long and probably had keen eyesight.

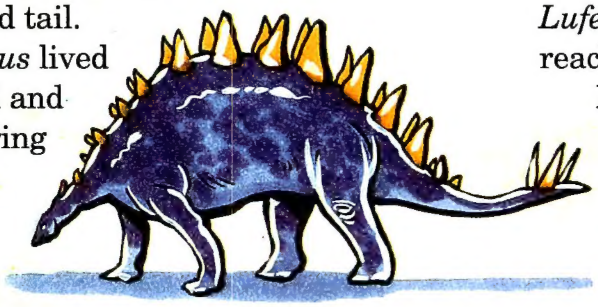
LESOTHOSAURUS 190 MYA

Lesothosaurus (le-so-to-saw-rus) was about a metre long. It lived in the hot, dry climate of southern Africa in the Early Jurassic Period. Some scientists think that *Lesothosaurus* had a special salt gland which enabled it to store water. The dinosaur used its slender neck to reach shoots and buds. It nipped them off with leaf-shaped teeth.



LEXOVISAURUS 160 MYA

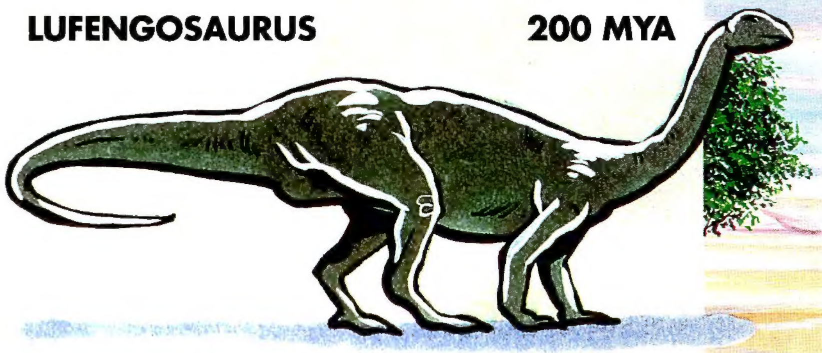
Lexovisaurus (lex-ove-ih-saw-rus) was named after the Lexovi, an ancient tribe from France. It was one of the first stegosaurs to be discovered. *Lexovisaurus* was as long as a Nile crocodile, and looked rather like *Kentrosaurus,* with two rows of narrow plates along its back and tail. *Lexovisaurus* lived in England and France during the Middle Jurassic Period.



LONCOSAURUS 80 MYA

Very little is known about this South American dinosaur. When *Loncosaurus* (lon-koh-saw-rus) was discovered in southern Argentina, only a thigh bone and some teeth remained. *Loncosaurus* lived towards the end of the Age of the Dinosaurs during the Late Cretaceous Period. The dinosaur was probably about the size of a large dog. Experts think that it fed on plants and probably walked on two legs. *Loncosaurus* means 'Lonco reptile'.

LUFENGOSAURUS 200 MYA

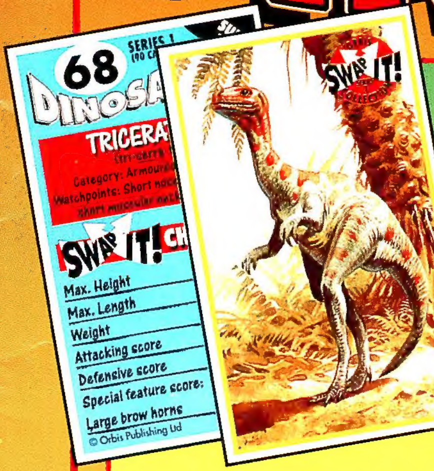


This Chinese dinosaur was almost as long as a large bull elephant – it measured about 6m. *Lufengosaurus* (loo-feng-oh-saw-rus) lived during the Late Triassic Period in China. It was first discovered in the 1930s. Since then, it has been found at several sites in different parts of China. *Lufengosaurus* had a long neck to help it reach the tastiest shoots on high branches. It stood on its strong hind legs and used widely spaced teeth to strip the leaves off branches. *Lufengosaurus* means 'reptile from Lu-feng'.

MYA = MILLION YEARS AGO

COMING IN PART 28 OF

DINOSAURS!



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DINOSAURS!
•DISCOVER THE GIANTS OF THE PREHISTORIC WORLD•
28
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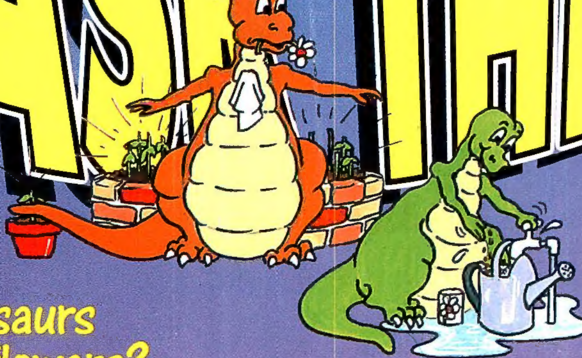
ANSWERS TO DINO FACT FILE QUESTIONS: 1.b 2.b 3.a 4.c 5.c 6.a 7.a 8.c 9.c 10.c

Dr. David Norman of Cambridge University answers your dinosaur questions

ASK THE EXPERT



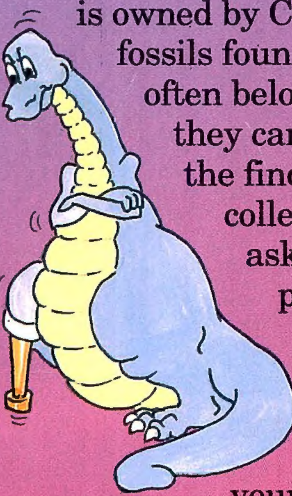
Did dinosaurs eat flowers?

The first flowers did not appear until Mid Cretaceous times, so the Triassic, Jurassic and Early Cretaceous dinosaurs would never have had the chance to eat flowers. But many plant-eating dinosaurs of the Late Cretaceous would have enjoyed eating flowers. A few of the tiny plant-eaters (hypsilophodontids) may have been experts at eating flowers, using their narrow beaks to nip the flowers off the stems.

Did duckbilled dinosaurs quack like ducks?

I suspect that duckbilled dinosaurs, despite their name, did not quack like ducks do today. They are much larger than ducks, so the quack, if they made one, would have been much louder and deeper, sounding more like a roar. Most hadrosaurs (duckbilled dinosaurs) seem to have made sounds by blowing air through their noses, so that the sound was more like a trombone.

If you find a dinosaur bone, who does it belong to?



That depends on where the bone was found. In Britain, fossils usually belong to the person who owns the land where the fossil was found. Much of the coast is owned by Crown Estates, so fossils found on the sea-shore often belong to the Crown, but they can usually be kept by the finder. If you want to collect fossils you must ask the land owner's permission. The law about fossils differs from country to country, so it is best to ask the advice of your nearest museum.

Could dinosaurs run?

When you think about the gigantic size of some dinosaurs it is hard to imagine them running at all. However, it is likely that most dinosaurs could run, or at least walk quite quickly. Some dinosaurs, such as *Deinonychus* – which had long legs and narrow feet – were undoubtedly designed to be able to run fast.

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